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A SMALL HANGING CUPBOARD WITH FRETWORK DOORS AND ENRICHMENTS — FULL-SIZE WORKING DRAWING FOR LEFT-HAND DOOR. By E. BONNEY STEYNE.

For Sketch of Cupboard complete and Full-Size Working Drawing of Enrichments in the form of Borders to the Various Parts, see next page. The Shields in the Doors are to be decorated with Coats-of-Arms in Heraldic Colours, Crest, or Monogram according to liking. As the left-hand Door is shown in the Drawing above given, it will be understood that for the Door to the right hand the Design must be reversed.

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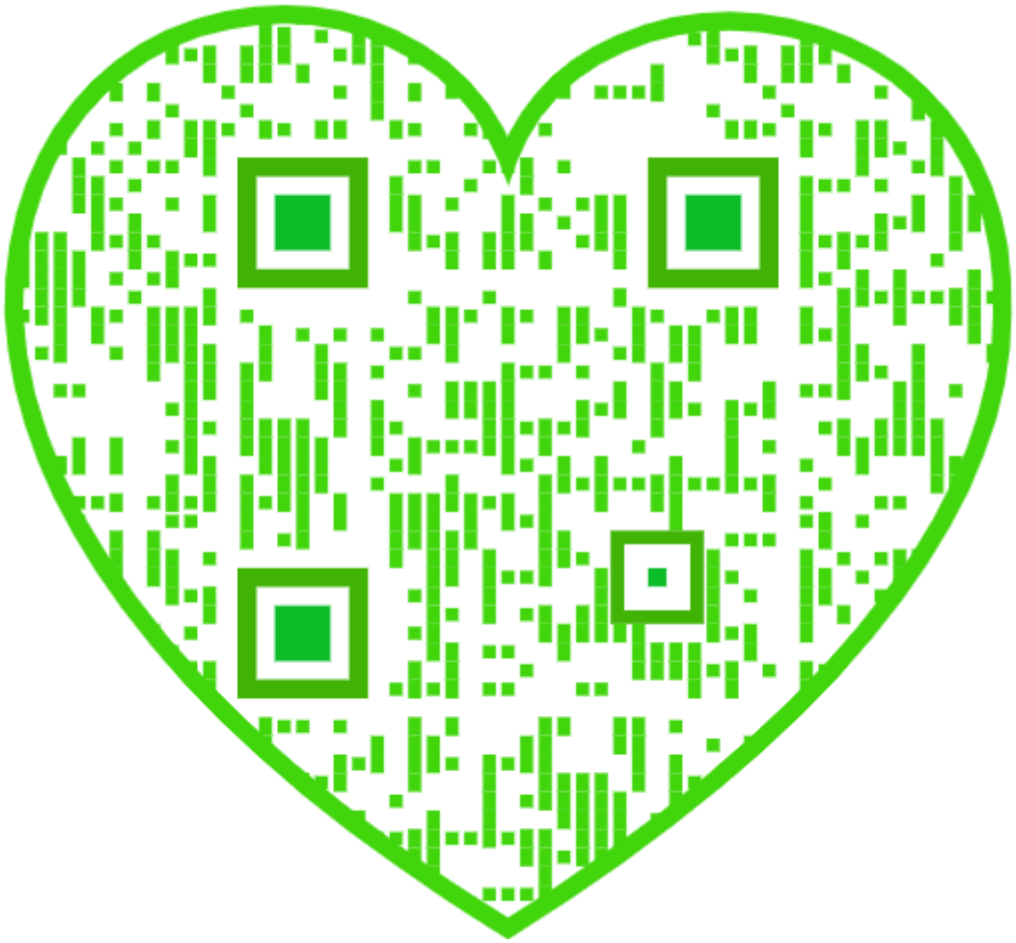

A SMALL HANGING CUPBOARD WITH FRETWORK DOORS AND ENRICHMENTS.

BY E. BONNEY STEYNE.

THE love of human nature for handy receptacles in which to store accumulated oddments—treasures, perhaps, to their possessors if lumber to all others—is no doubt as old as the love of collecting such things. Whether the virtue of tidiness is equally old is another question. As we delve into early history we are surprised at the antiquity of vices. From the comparatively harmless pun to the most tragic crimes that set a continent aghast with horror, we find, alas, that our ancestors knew them all. Of some virtues we may almost trace the first example, and tidiness, we fancy (if it be, indeed, a virtue, and not a deplorable vice, which delicate point may be left to the casuists among our readers), at least in its modern sense, is an artificial product, caused by the more artificial conditions under which we now exist. Tidiness is, we know, a very domestic virtue, if not exclusively feminine, yet one that is specially inculcated by the rulers of home, where the Salic law is so rarely in operation. Consequently, if the powers that be object to "more useless ornaments," when the amateur craftsman presents his thirteenth bracket, his twenty-fifth pipe-rack, or his fiftieth photo-frame, let him take warning; and that his hobby may not become a curse to his household, let him try a few useful articles to propitiate the offended goddess, whether she be wife, aunt, sister, or "a nearer one yet and a dearer one still," as the poet has sung with unconscious satire.

Of all articles makeable by an amateur joiner, a set of two or three shelves with the lower space enclosed by two plain doors is surely among the easiest. By plain doors I mean the use of just a solid piece of wood in place of framed and panelled ones, which are, of course, preferable, if the skill of the worker is able to achieve it.

The form of this little structure is so commonplace that it hardly needs explaining by diagrams, for if any piece of furniture in the whole range of such is easily seen and studied from the actual example it is surely this. In one near me as I write, the shelves are just screwed into through the uprights; in one I noticed ten minutes ago in passing a shop the shelves were boldly tenoned through the end pieces and secured by pegs. Another has them grooved into the uprights and fastened by nails. A backing of wood serves the double purpose of enclosing the cupboard and keeping the framework taut, with no lateral play of the joints. It is best in all such work to fit the doors before sawing, then, by simply unscrewing the hinges, they are ready to receive the design.

But whatever may be the way in which the parts are put together, the appearance of the finished cupboard as shown in Fig. 3 will be much the same. In Figs. 1 and 2 are shown full size the fretwork doors and bands. The pattern of the band may be repeated from end to end, or broken by a medallion, as shown by dotted lines in Fig. 2, and the design reversed.

The shields are intended to bear a painted heraldic device, a crest, or to be decorated with a monogram cut in very thin wood and glued on. To end in cookery book phrases—stain, polish, or otherwise finish to taste; time (uncertain in season at any time), sufficient for the needs of one person.

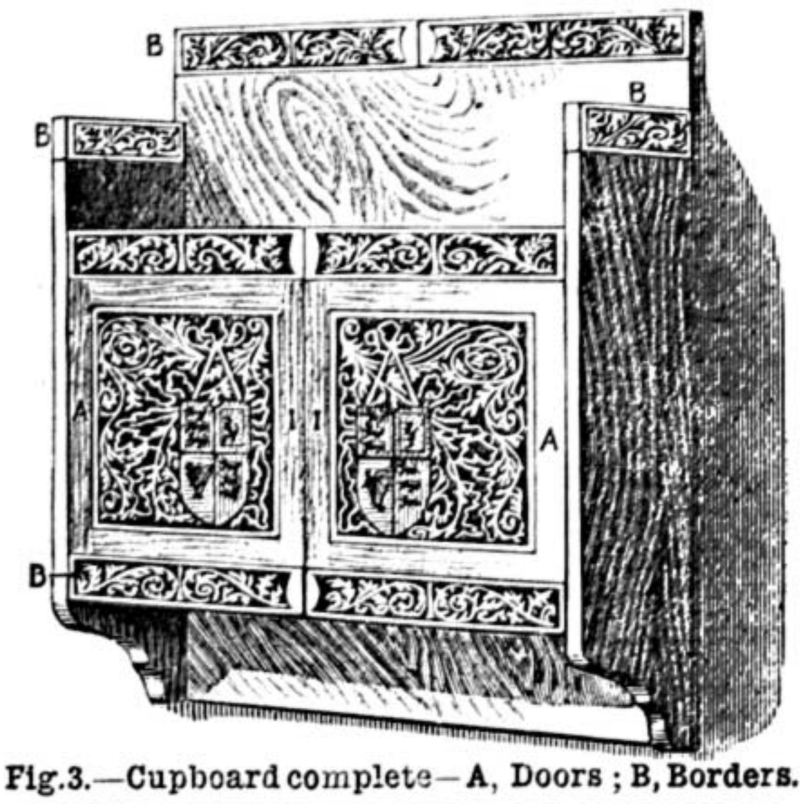

Fig. 3.—Cupboard complete—A, Doors; B, Borders.

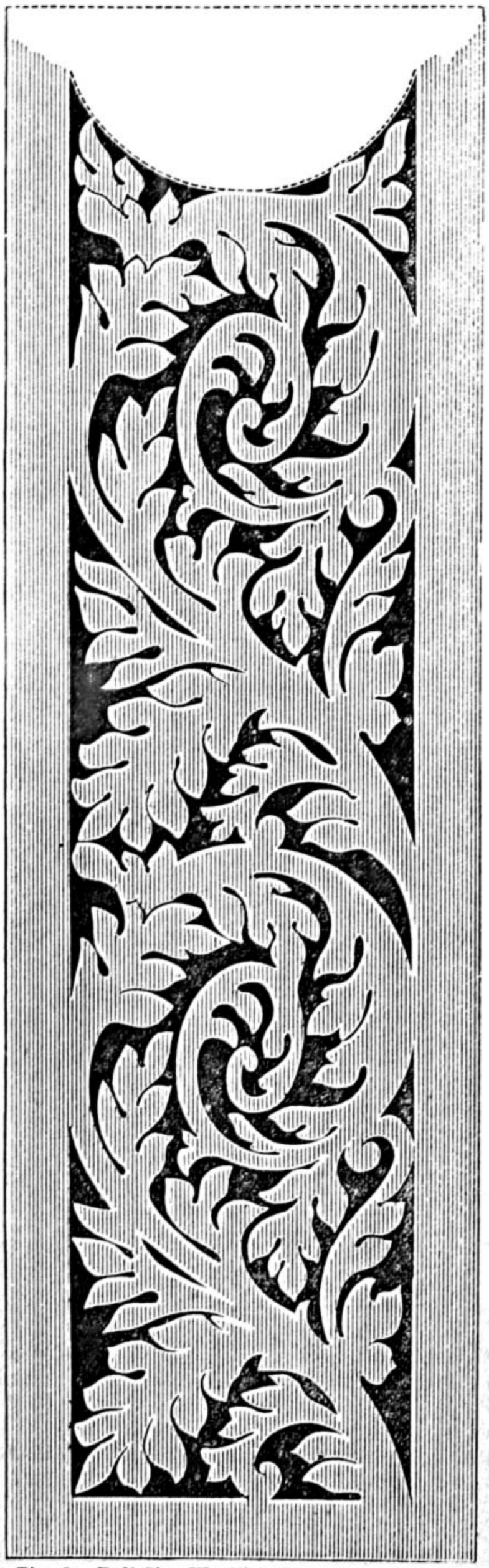

Fig. 2.—Full-Size Working Drawing of Border.

AN ARMCHAIR: HOW TO MAKE THE FRAME AND UPHOLSTER IT.

BY DAVID ADAMSON.

SEATS OF CHAIRS—MATERIALS FOR UPHOLSTERY—WEBBING—CANVAS—STUFFING—WADDING—COVERINGS—MOROCCOS—ROANS—LEATHER CLOTH—VELVETS—SADDLE-BAGS—TRIMMINGS—UPHOLSTERER'S TOOLS—STRETCHING AND FIXING WEBS—LAYING CANVAS.

As is well known, seats may be either spring-stuffed or hard, buttoned or plain. We will consider this one as being without either springs or buttons, as this arrangement presents fewer difficulties to the novice, besides being perhaps rather more in keeping with the general character of the chair. Besides being simpler to make, a plain unbuttoned seat allows of a greater range in choice of covering materials; but without giving reasons in full for the selection of this kind of upholstery, it will suffice to give instructions for stuffing and covering seat and back in a proper manner.

The materials proper for the work are webbing; thin canvas; scrim, which is a very loosely woven canvas; calico; some stuffing material, of which curled hair as prepared for upholstery purposes is the best; wadding; tacks; twine; outer covering; and several minor odds and ends, which will all be considered in due course.

Perhaps a few remarks on the principal materials may not be amiss before beginning work. All of them may be got from any upholsterer in quantities which may be suitable. Wholesale dealers and manufacturers, as a rule, will not supply in retail quantity, so that the novice, at any rate, will do well to purchase what he requires from some local furniture shop where upholstery work is done.

The webbing is a banding of about a couple of inches in width. It is of the utmost importance that it should be of good quality and properly stretched, as it supports the greater part of the stuffing. If the webbing gives way, the seat is bound to follow.

For the canvas, scrim and calico are generally used, though almost any fairly strong fabric may be used, and the qualities required will be easily perceived as the description proceeds. For the tacks, a suitable size will be ⅝ in.

Almost any fine strong twine will do, but that used by upholsterers (a kind of whipcord) is the best for the purpose. The quality of the stuffing material is very important, for not only the comfort, but the appearance and durability of the chair largely depend on it.

As has been said, curled horsehair is the best material when it is of good quality; but let me caution all against the use of old hair—that is, hair which has been taken out of old work, especially that from bedding—unless its source is known. What may be called second-hand hair is offered at very low prices by marine store dealers, low-class brokers, etc., but it should be always looked on with suspicion. It is certainly hair, but it is not to be compared with good new stuff in any way, while there are obvious risks attending its use, unless it has been thoroughly re-made; in which case, for all practical purposes, it may be regarded as new material. It may not be generally known that curled hair cannot be simply washed unless it is also thoroughly redressed. I say this, as not very long ago I saw in a popular magazine some instructions purporting to tell how to renovate old

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hair, and among other details, it was stated that it should be washed. Now, washing would get rid of dirt, of course, and to that extent might be of benefit; but if merely dried afterwards, as was directed in the article referred to, the hair would have lost all the principal qualities which render it valuable as a stuffing material. It would be dead and limp, without the springiness which is one of the essential features of a good stuffing. The proper preparation of curled hair is rather an elaborate one, which it is needless to enter upon here in detail. It will suffice to say that the hair is first made into tight ropes, which are subsequently baked or heated, after having been soaked in water, and then untwisted. When sufficiently loosened, it is ready for use; and I should advise readers to buy it towsed instead of in the rope. It will cost very little more, and the labour of unpicking the rope is very uninteresting, and not at all remunerative to the man who can employ his time otherwise. Good hair is obtainable at from 1s. to 1s. 6d. per pound. It is to be had at much lower prices, but the commoner qualities are generally largely adulterated with inferior materials.

Besides hair, various other materials may be used for stuffing purposes. Among the most general are *Crin vegetal*, or vegetable hair, cotton flock, and alva. The former is a preparation of the fibres of a plant, and is chiefly brought to this country from the northern coast of Africa. Flock is too well known to require any explanation. Alva is a seaweed, of which there are at least two kinds used—viz., the German and the French. The former is inferior to the latter, which is crisper and with more spring in it. None of the vegetable fibres are, however, to be compared with hair, as they do not present the same amount of elasticity. Let the novice take a handful of each material and compress it. Good hair will expand again on pressure being removed, while the others will do so only to a very limited extent. In use, seats stuffed with them become hard and lumpy very soon, while hair retains its spring for a considerable time, though, of course, it too eventually becomes matted.

The wadding is what is often known as "cotton-wool," being a finely worked cotton, sold in loosely fitted sheets sized over on both sides. The size, drying, forms a kind of skin. I think it is to be had from drapery as well as upholstery shops. It is prepared either grey or white, and is sold by the yard. To use, it is split open, dividing its thickness; and its object is principally to soften the harshness of the stuffing to the sitter. It is sometimes omitted.

About the covering a good deal might be said, but I can only glance at a few of the materials, leaving the worker to make his own selection. There are leathers of various kinds, and these may be taken first.

Moroccos are deservedly popular, but they are hardly suitable for a beginner to work with. They wear well, and can be had in almost any shade or colour. They are goat-skins, and must not be confounded with roans or sheep-skins. The two are remarkably alike in general appearance, but there is much less wear in the latter, which are often substituted for the others by unscrupulous dealers, on account of their lower price.

For the outsides of backs, where there is little or no wear, roans do very well instead of the more costly and durable moroccos. Hog-skins, specially prepared for upholstery, have come much into favour within the last few years. They are both durable and handsome, the principal manufacturers stamping them with various good patterns. They are, however, like moroccos, not the easiest materials to use.

Very closely resembling the real thing are some of the imitations, or leather cloths. The better qualities wear remarkably well—far better than some real leathers. Crockett's leather cloth is of world-wide fame, and, apart from its durability, is preferable to some of the newer introductions. I need only remind those who think of using an imitation of leather that some of the leather cloths are very inferior, and that as the best is very inexpensive, it is scarcely worth while to use anything else.

Velvets and various woven fabrics are much in use now, and have to a great extent supplanted leather, as there is no question that, for durability, some of them are superior even to the best morocco. This applies specially to velvets. Of these, the suitable kinds for such a chair as the present one are the plain Utrecht, or mohair, and the frieze. The former are generally plain, but may be had stamped. The latter have a pattern woven in with them, and have almost superseded the stamped Utrecht.

With these velvets may be classed the now well-known saddle-bags, which, with few exceptions, are made up only in squares, so that for coverings they are generally used along with plain Utrecht to make up the necessary sizes.

Very much resembling saddle-bags is the material called moquette, which is made up in the same style of semi-Oriental patterns and colours, and in lengths like ordinary piece-stuffs. Velvets of the ordinary kinds—Utrechts and friezes—it should be said, are only made in self-colours, but are to be had in almost an endless variety of tint.

Beyond these few, there is an immense variety of covering materials, but none of them are so suitable for the present chair, unless, perhaps, it may be some of the tapestries, and a few others, which, though not in general use, may be regarded as more or less fit for the purpose.

Various trimmings—such as gimp and studs—will also be necessary to give an adequate finish to the upholstery. They will, to a great extent, depend on the covering material, but as it is clearly impossible to define them all, it must suffice to mention one or two. With a real or imitation leather covering, the best gimp to use will be leather; the studs also may be either covered to match or plain metal. Without any banding, these may be used by driving them in close together. For velvet coverings, either a leather or velvet banding may be chosen, and the studs be as before, or velvet-covered.

Now, with some general idea of the materials to be used, let us see how to work them up. To do this, beyond a long upholsterer's needle, no special tools are absolutely necessary, though an upholsterer's hammer, a web strainer, and a regulator will be conveniences. They may, however, be dispensed with, and easy substitutes found for them. The hammer generally used has a long, thin head, with a very small face and thin claw; but for occasional use an ordinary hammer will do very fairly. The web-strainer may easily be made at home, but as I purpose at no very distant date describing its construction in detail, those who are not provided with one may make use of a straight piece of wood for the purpose of stretching the web when tacking it down. The sizes of this extemporised tool are not important, as will be seen later on. For the regulator (which is a steel rod tapering to a point at one end, and flattened out towards the other), the needle may be made to serve. All the outlay, it will thus be seen, may be confined to the actual materials used in the upholstery, which the learner is now sufficiently informed about to be able to proceed with.

First, the webbing must be fastened to the seat and back. Let us take the former for the purpose of description, premising that it is understood the pieces from back to front are interlaced—that is to say, first over and then under those extending from side to side. Four strands each way might do, but five will be better for a chair of this size, and as the webbing is inexpensive, it is better to err on the side of excess. The spaces between each should be, as nearly as possible, the same, but extreme accuracy is not requisite. Now, please follow the movements thus: Turn under the loose end of the web, and put it down on the top of the back (or any other) rail, the length of the web being towards the opposite one. Fasten the end down with, say, four tacks, not less than half an inch from the inner edge of the rail. Now get the piece of wood serving for strainer, rest one end of it against the outer edge of the rail opposite to that to which the web has been already tacked, pass the web over the other end, grasp it and the web tightly with the left hand, and depress it till the web is thoroughly taut and level with the top of the rail. Still holding tight, drive three or four tacks in. The stretcher for this strand has done all that is required of it, and may be relinquished. Cut the web off, say, an inch from the tacks, turn over the loose bit, and fasten it down with a couple more tacks. It will be seen that the improvised web-strainer acts as a lever, and all that is required is that it should be at least as wide as the web, stout enough not to break, and long enough to get sufficient pressure. If it is found impossible to hold the web and it so tightly in the hand as to prevent the web from slipping, a remedy may easily be found by passing the web along the under side of the lever, and gripping it between the end and the seat rail. The remainder of the webbing is fastened in exactly the same manner, and every precaution must be taken that it is well stretched. Sometimes, to make sure that it is stretched to the fullest extent, it is strained before use by letting it remain suspended over a beam, with heavy weights attached to the ends. However, it does not matter whether this is done, provided it is strained to the utmost before it is tacked down.

The webbing on the back is done in the same way, the tacks being driven into the front—that is, the webs lie on the inner side of the back.

Over the webs lay the canvas, or, as it is often spoken of, from the kind that is used, Hessian. As this canvas does not have the same weight to support as the web, smaller tacks will do very well for fastening it down. The best way to proceed will be to cut the canvas a trifle larger than the seat frame, to allow of the edges being turned over to the extent of 1 in. or so all round. Then put one tack through the centre at the back, and drive in other tacks at intervals of 1½ in. to 2 in., at the same time pulling the canvas always tightly with the left hand, and driving the tacks through the turned-over margin. When the whole of the back rail has been done, continue along the right side of the frame towards the front rail, always pulling the canvas tightly

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with the left hand. Proceed in a similar manner along the front and remaining side rail. Care must be taken at the legs not to cut the canvas too finely, as if this is done the hair or stuffing will very likely come through. It will be better to leave the canvas full here, so that it may be slightly turned up, and if necessary, tacked to the legs. The back also has canvas laid over the web in a similar way.

THE ART OF GRAINING.

BY A LONDON DECORATOR.

Imitations of Inlaid Woods.

The art of *inlaying*—a word that explains itself—has been practised to some extent for many centuries. Mosaic—perhaps the most ancient—marquetry and parquetry, and the inlaying of metals, are all four different methods of working out the same idea of ornamentation. With the metals and mineral products we have here no concern, whilst the connection of these papers with marquetry work—the inlaying of furniture—and parquetry—its application to floors—can only be of a somewhat remote nature. A general *résumé* of these inlaying arts would doubtless serve as the best introduction to studying their painted imitations—since both painted mosaic and metal inlays are as practically useful in decoration as those of woods—but for the present the student must look for this in other directions. All I can attempt to do in the space of two short papers is to explain how, in connection with these lessons on graining, the technical processes of painting, graining, outlining, staining, etc., are so manipulated as to obtain the desired imitations of inlaid woodwork.

Suitable Designs for Inlaying are factors in this work upon which much of the resultant success will depend. The production of good ornamental design—that which is original—can seldom be forthcoming without the combined resources of a natural inventive faculty and a trained eye and hand. Very few grainers lay claim to being also ornamental designers, and fewer still can justify that claim. Perhaps the next best thing to being able to "create" an ornament is to know when a design is suitable for any particular purpose. This knowledge should be possessed by the imitator of woods in its application to inlaid work. Without, therefore, presuming to initiate my practical readers into mythical principles of idealistic lines and contours upon which, presumably, ornamental forms are produced, I will indicate simply how, and why so, a design for inlaying should be arranged.

The ornament, in the first place, should be of the nature termed "flat," and therefore akin to that for stencilling. The basis of the idea, that of "laying in" one wood upon another, resents any attempt at shadow or rounding, whilst the first principle of construction—viz., utility—is outraged if we attempt "light and shade" upon surfaces like table tops and the floors we walk upon, whether it be in mosaic work or parquetry. *Colour* in inlaid work has certainly some purpose and mission, but form is of chief importance, and therefore very careful and accurate drawing is required. Contrast of light against dark, and not colour-contrast—a distinction with a difference—is the means whereby the ornamental form is displayed. In the more elaborate specimens of marquetry, conventional representations of material forms and figures are, however, sometimes executed. Outlining with light wood or black is then resorted to, that the design may be properly defined; and, in such cases, the colour-stained woods are used to give a soft richness and to help make a picture. The margin between that *correct art*, which ornaments the constructive and useful, and the *bad art*, which sacrifices all sense of use and first purpose to ornamentation, is here but a very narrow boundary line. The coloured inlays of the Italian mediæval work and the costly "Buhl" work of French production are usually free from any such reproach, since in these productions we find the same excellence attained as in the best Persian painted decoration, where light and shade is *suggested* to perfection, but never directly *represented*.

In the imitation of inlays a learner's best effects are commonly obtained by graining woods in their natural colours, leaving the pyrochromatic arrangements for the perfected skill of experienced workers. His scope is by no means limited thereby, as a glance at the woods mentioned in the preceding paper will prove. Two or three well-arranged varieties, worked into a good design, give but little trouble, and amply repay the time and labour involved.

We will now interest ourselves with simple methods and treatments, chiefly in their connection with and applicability to the woodwork of buildings, leaving to the final paper the execution of more difficult and intricate panels and table tops.

The *Grounds for Imitation Inlays* should invariably be light in colour. A perfectly level surface must be maintained, and it is by this desideratum our methods are governed. It is quite apparent to anyone possessing only a slight knowledge of painting that an opaque white ornament cannot be obtained against a dark background without the former being coated so many times as to destroy the even surface. On the other hand, it is possible to cover up portions of a light ground, even to blackness, without any appreciable thickness of pigment, hence the reason for light grounds. When white, unpainted wood is the ground worked upon, for simple inlays we may prepare the surface with a coat of varnish, and thenceforward treat as a painted ground. For delicate work, however, in which we desire to stain the wood itself, a totally different plan is advisable; this we will consider later on.

Inlaid Floor Margins have occasionally provided work for the grainer for many weeks in the "good old days." Although the real parquetry is now so cheap that its imitations may seldom furnish employment for the operative, this branch may well be followed by the amateur worker. Many persons now use a margin of imitation parquet linoleum, in place of the plain staining of floor boards, but there is little doubt that a stained ornamental border would be generally preferred to either.

The two simple border-ornaments (Figs. 1 and 2) in the accompanying page of illustrations are arranged upon the scale of one inch to the foot. The width of eighteen inches is one that can be easily adapted to the size of ordinary floor boards. Fig. 1 is intended for two woods only—dark walnut upon a light oak. Fig. 2 is made more ornate and effective by the further addition of ebony wood imitation. To apply these designs we first make a full-size line drawing of the border, and from that make a tracing upon a piece of cartridge-paper. This is easily done by rubbing over the back of the outline drawing with a little dry red or black lead, then pinning the two together upon a table with drawing-pins and marking over the drawing with a fine-pointed stick or pen-holder. The colour is thereby pressed into the face of the cartridge-paper. We make a tracing upon cartridge-paper for each different wood used—hence two for border Fig. 2—and then cut out the parts of the design corresponding to the wood. When the design is of one colour only, one stencil is sufficient; but it may be necessary to make good the ties by hand afterwards, in which case it takes as long as working two stencils. The floor must be well cleaned, and as smooth and level as we are able to get it. It is advisable to strike two or three chalk lines, marking the centre and extremes of the border to which we work the stencil. The corners are best set out separately and put in by hand, unless of an intricate nature, when it will be quickest to use stencils. A coat of hard-drying oak varnish, stained with raw sienna in oil and a little raw umber, is first spread over the whole margin to get the oak colour and prepare the wood also. The border being set out when this is dry, we first stencil in the walnut, using burnt umber with the same varnish, and then lampblack with varnish for the ebony. The first varnish coating enables us to stencil these cleanly, and the marginal lines are put in last with a fitch and straight-edge. A coat of hard-drying varnish all over, and then rubbing with beeswax and turps, will make a good and durable finish.

Plain Panelled Dados and Wainscot are woodwork of a higher order of construction, and with such as these simple inlays may be admirably worked. For chapels or school-rooms wherein are large quantities to be treated, our ornament must be both suitable and easily executed. The "board-rooms" of public bodies are often provided with cheap panelling, and when the wood is pitch-pine the introduction of more elaborate inlay treatments would be very appropriate. I therefore show two suggestions of design (Figs. 3 and 4), in both of which a black outline may be pencilled on with beer and lampblack after the stencils are used, or the design may be all black. The preparatory coating of varnish is here also advised, and the ornament executed upon the same plan as for the floor borders. These, I am well aware, may be but "bastard" imitation inlays. It would, however, be worse than useless to attempt the same expensive method for cheap panelling as we should use upon a table top. Stencils, if specially designed and cleanly cut and used, will bear all reasonable inspection, and if time can be spared to paint the fine black outline by hand, there will be no perceptible thickness to mitigate against the desired inlay effect.

Simple Inlay Designs for Grained Doors will now be within the scope of learners who have worked at the previous easier treatments. These samples (Figs. 5—8) are intended to be worked in two varieties of wood upon a third. Figs. 5—7 may be used upon maple-graining with mahogany or walnut ornament, and black for fine detail and lines. Figs. 6 and 8 are upon walnut ground, with ornament in maple, grey hair-wood, and amboyna. Besides these complete panels, which will enable the worker to judge the effect of a finished panel, I give in Figs. 9 and 10 some very easy corner ornaments, which make up neat and pleasing panels by using them in the corners and joining with fine lines. Figs. 11 and 12 represent simple scroll borders, useful either for panels or the flat member of a door architrave.

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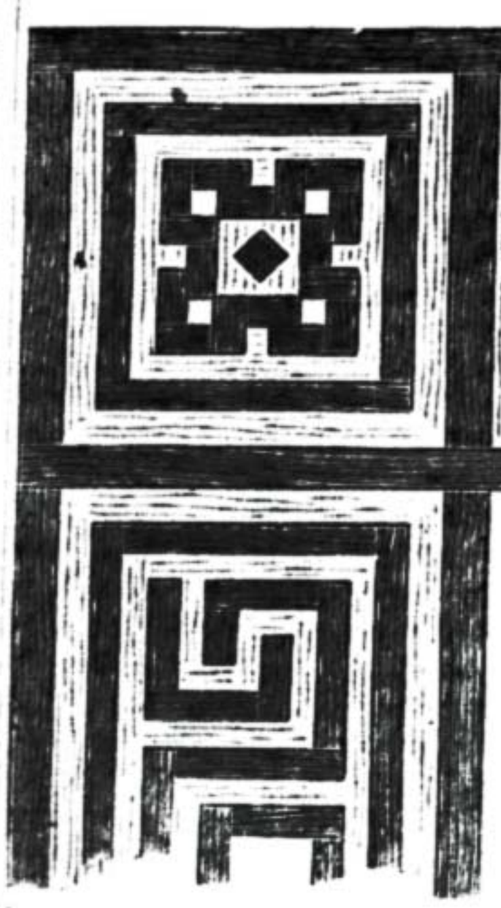

Fig. 1.

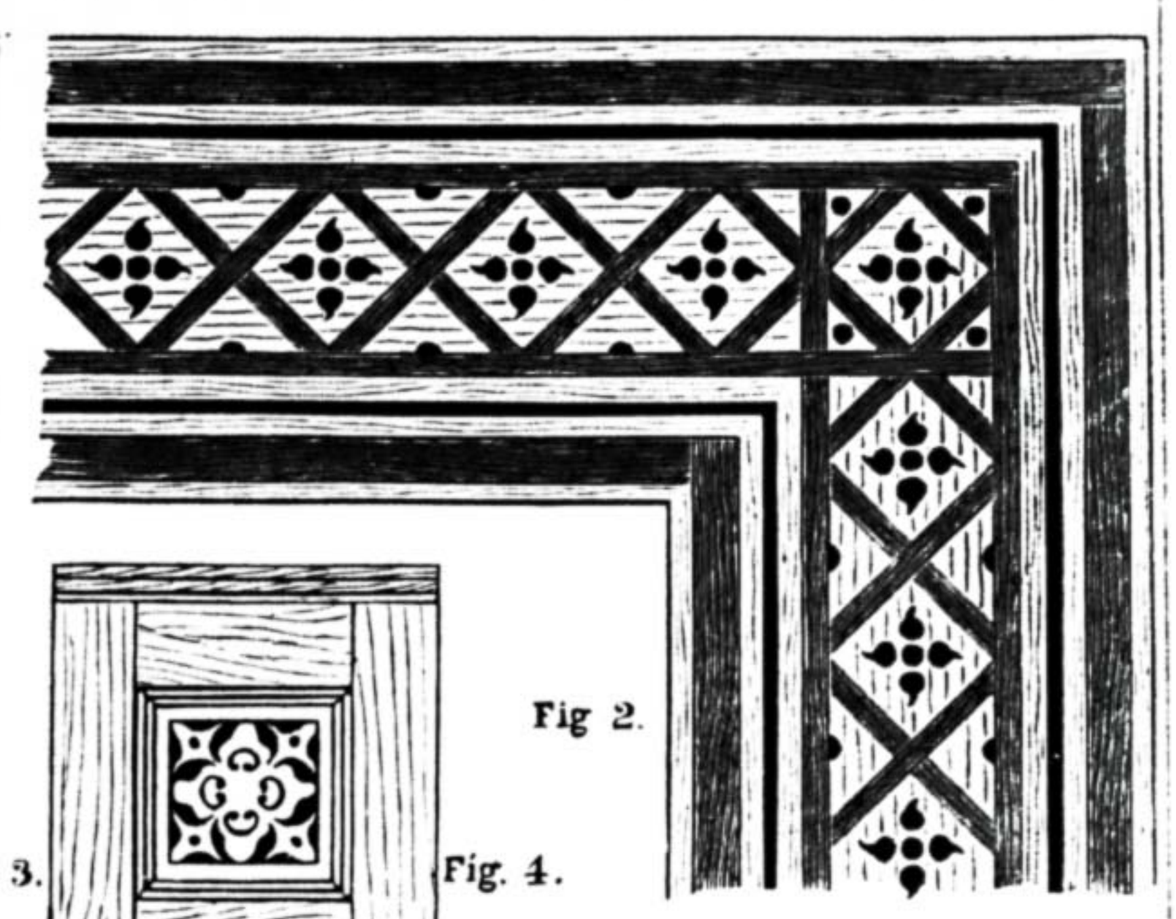

Fig 2.

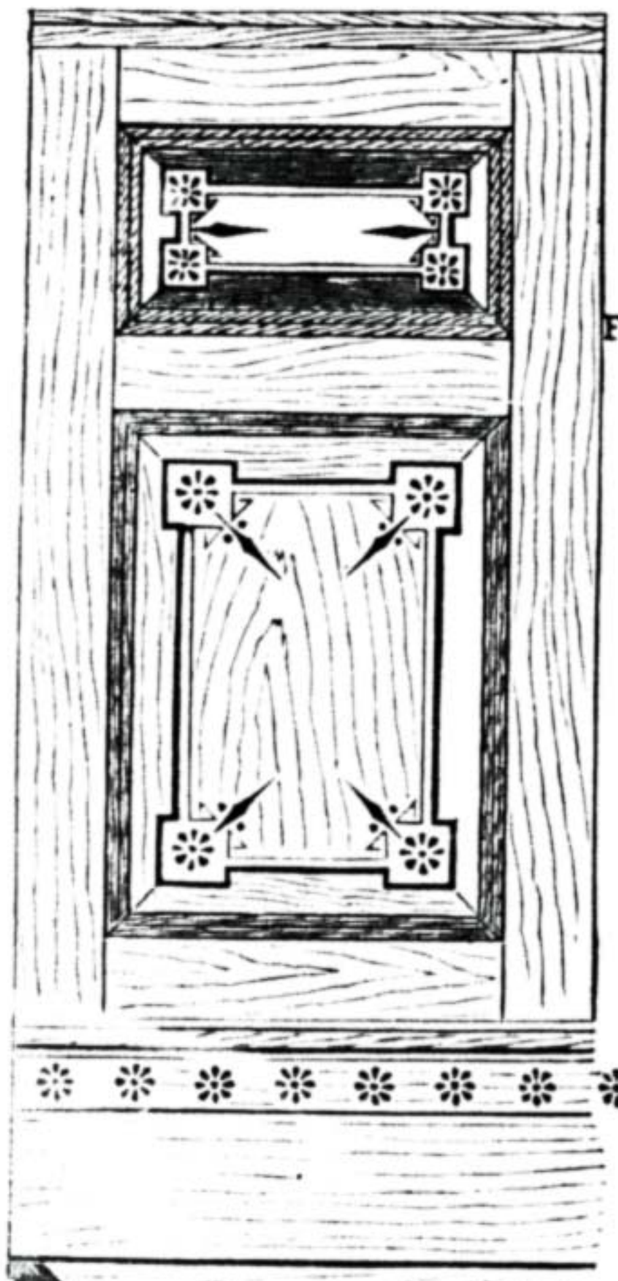

Fig. 3.

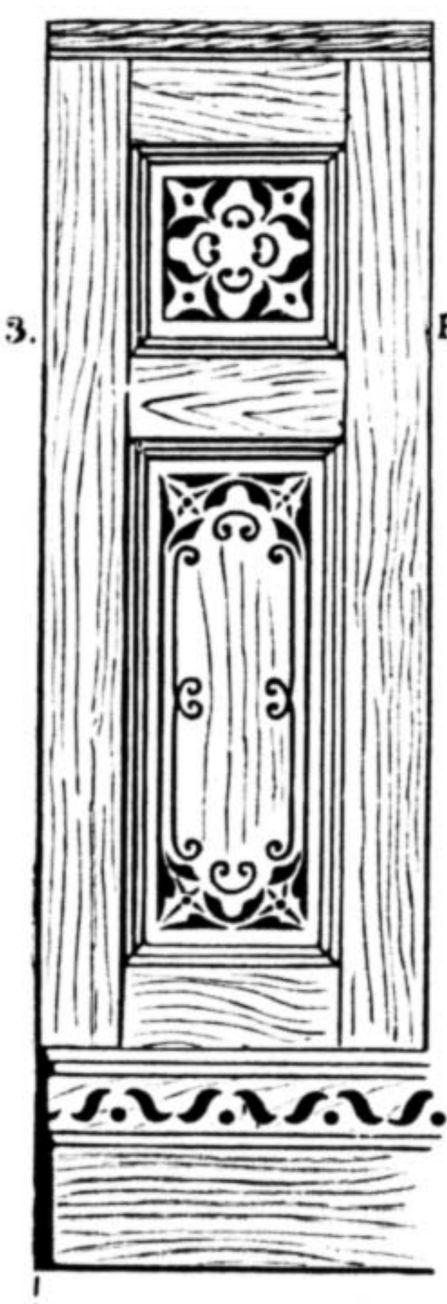

Fig. 4.

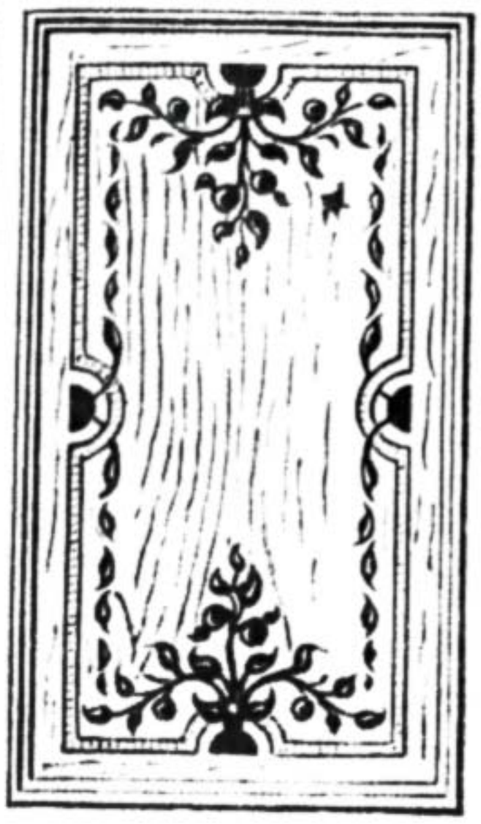

Fig. 5.

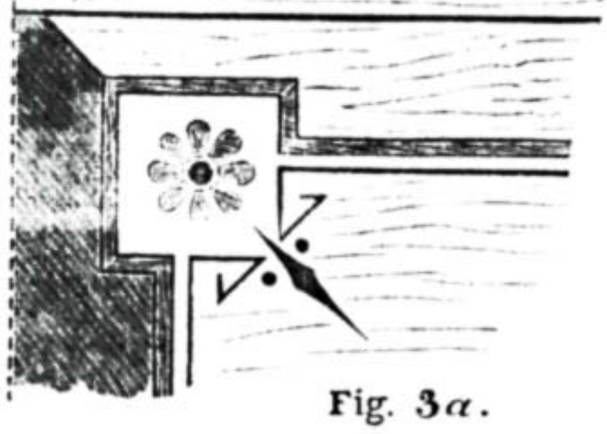

Fig. 3a.

Fig. 4a.

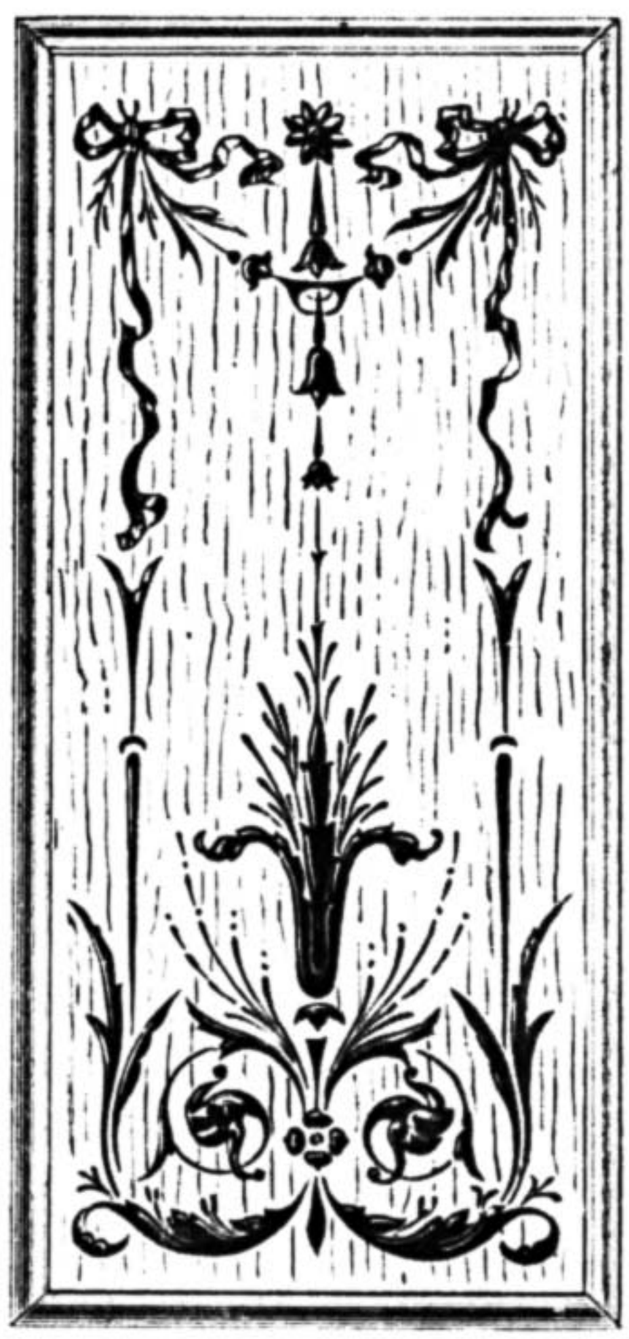

Fig. 7.

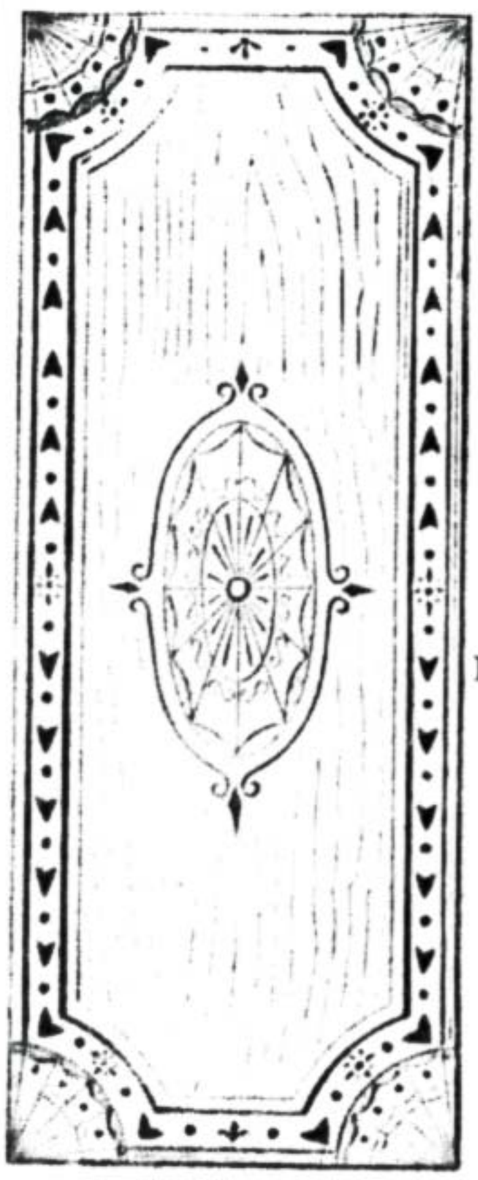

Fig 6

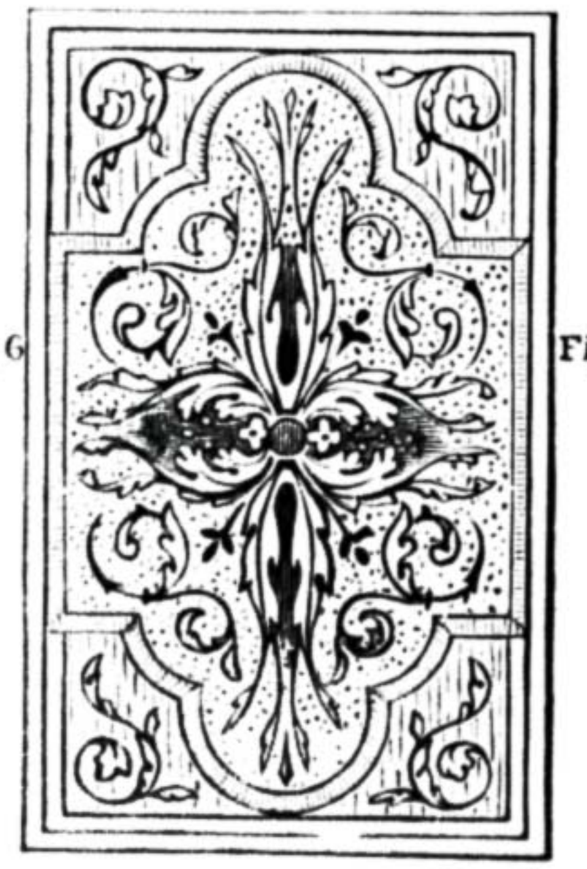

Fig 8

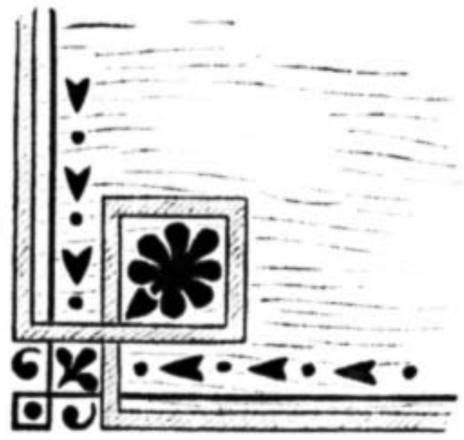

Fig. 9.

Fig. 10.

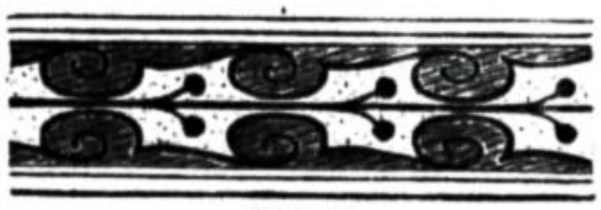

Fig. 11.

Fig. 12.

Fig. 1. Suggestion for Floor Margin in Old "Key" Pattern. Fig. 2.—Another Suggestion for Floor Margin. Figs. 3, 4.—Treatments for Panelling in Imitations of Inlaid Work. Figs. 3a, 4a.—Corners of Larger Panels in Figs. 3, 4, enlarged. Fig. 5.—Panel Treatments in Walnut and Ebony on Light Wood for Dining-Room. Fig. 7. Ditto for Drawing-Room. Figs. 6, 8.—Fancy Panels—Light Woods on Dark. Figs. 9, 10. Corners for Panels. Figs. 11, 12. Simple Borders in Imitation Inlaid Work.

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A zealous student with a little knowledge of drawing will very soon augment this little selection of ornaments. We are surrounded at all times, in the streets of the city and at the fireside, with different ornamental forms and expressions. A faculty for adapting lineal forms to the special requirements of our work is the essence of that which is commonly termed designing; for the beauty and perfection of an ornament is not judged solely by its lines of grace or intricacy, but rather by its fitness for the position it occupies and exigencies of the material we work in. It is, therefore, indubitably apparent that the man who executes the inlay should make a better design than the draughtsman who is ignorant of the practical work and technique.

Methods of executing Grained Inlays may now be explained. Since one general system of working will apply to all my panel illustrations, I will take Figs. 7 and 8 and show how to grain them upon painted grounds.

For both panels we "get up" the surface and "ground" them for maple imitation. Our first sample being darker woods upon maple background, we proceed to imitate the latter wood—with distemper colour as previously described—all over the panel. As we are to enrich this panel by ornament, we purposely keep the maple figure very subdued and finish it entirely before we varnish. The panel being now ready for the other woods, we have first to make a careful drawing of the ornamental outline and prick this through at very close intervals. For small work a sheet of thin notepaper answers admirably. Having now our pounced drawing, we also make a little muslin bag of cheap dry ultramarine, or any similar finely ground pigment, for conveying our design to the panel. Before this is required we take our distemper colours, vandyke brown, etc., and a little beer, and grain over the corners of the panel or wherever the walnut portions of the design come. This can be roughly judged by the eye alone, or if much walnut is wanted we grain the whole panel. We have now to secure those parts of the walnut we want for the design and to remove the superfluity. This end we attain by painting the design with a vehicle of any nature which we can afterwards remove by a solvent and brush, and such as water will not effect. For this purpose a little finest Brunswick black will answer best with painted inlays. We, therefore—the walnut being dry—now pounce the design thereon, and then carefully paint the walnut portions in with a sable pencil and the black. The latter dries quickly, and the superfluous walnut is then cleaned off the maple with a soft sponge and warm water. We have now the black, or ebony, to execute. We take a little black pigment—lampblack will do, but far preferably ivory black (see preceding paper, page 738)—and this being ground to the finest quality is rubbed upon the palette with a little beer only. We now take a soft camel-hair brush or the mottler, and brush over those parts of the panel where black is required. If the distemper black is spread carefully a very thin coating will cover. When this is dry we again pounce in the design. If we use fine drawing-paper and drawing-pins we may easily fix the pounce correctly by pinning into the first set of holes. We now cover the black parts with the Brunswick black, and when dry clean off the superfluity of distemper colour with water. All again being thoroughly dry we carefully damp over the Brunswick with clean, pure oil of turpentine, and after a little time we are enabled to remove it all with a soft camel-hair tool, leaving the walnut and ebony ornament, sharp and clean, upon the maple panel.

With panel Fig. 8, upon walnut ground, we adopt the same expedient. First we make the grey hair-wood, pounce and black it in, clean the panel, and then grain maple all over or where wanted only, just as we please, but keeping the figure very faint, since walnut will cover most of it. We paint in the maple parts with Brunswick as before, and then, without cleaning off, since amboyna is a stronger coloured variety, grain our amboyna parts. This being bound down where permanently required, we take our beer colours and overgrainers and grain the panel walnut all over. When thoroughly dry, we take the turpentine solvent and soak off and remove the Brunswick black, leaving the ornament in maple, hair-wood, and amboyna against the walnut background. The panel is now ready for two coats of copal varnish, the lightest and best quality of which is desirable.

THE TRIUNIAL OPTICAL LANTERN: HOW TO MAKE IT.

BY CHARLES A. PARKER.

CLAMPING PLATES FOR TOP LANTERN — FUNCTIONS OF CONDENSERS AND OBJECTIVES — COMPOUND PLANO-CONVEX CONDENSER — MENISCUS AND BI-CONVEX CONDENSER—SELECTION OF CONDENSERS—BAYONET FITTING FOR CONDENSER CELL — LANTERN OBJECTIVES—LONG FOCUS LENSES—FLASHERS—PREPARATION OF OXYGEN GAS—RETORT—PURIFIER—GAS-BAG—PREPARATION OF HYDROGEN GAS—GAS IN CYLINDERS—BLOW-THROUGH JET—MIXED JET—JET TRAY—LIMES—DISSOLVER—HANDLES—CURTAIN TO SCREEN LIGHT FROM JETS — LIGHTING UP — SCREEN AND SCREEN STAND.

IT will now be requisite to affix a couple of screw clamping plates to the upper portion of the woodwork on either side of the second lantern, for the purpose of securing the third lantern in position. These clamping plates and screws can be obtained ready for use from any manufacturing optician, or, if preferred, the registering stops previously mentioned will be found to form capital substitutes. In this case, however, the plate of the clamp will not require bending, but should be screwed on to the upper portion of the woodwork of the second lantern with a small bush (similar to the one soldered on the plate), screwed into the woodwork at the bottom of the third lantern in a suitable position to engage the milled screw of the clamping plate, which is then screwed into the bush, thus serving to secure the top lantern in position. It will be found sufficient to cut in half the ordinary bush supplied with the clamping screw, soldering one-half on to the brass plate, and screwing the remaining half into the woodwork of the lantern body. The arrangement of the clamping plate will be readily understood by reference to Fig. 34 (page 708), which is a section of the lantern body, showing the plate screwed in position on the woodwork.

As the preceding papers have been entirely occupied by the constructive details of the lantern, it has been necessary to reserve all mention of the condensers and the objectives until this, the concluding paper of the present series; and as various matters of more or less importance still remain to be treated, it will be requisite to deal but briefly with the optical portion of the subject. The reader must understand that the condenser has nothing to do with the formation of the image upon the screen, its function being to concentrate, or condense, all the light emitted by the jet upon the small transparent slide, the front lens, or objective, as it is more properly called, serving to project the picture so illuminated in a magnified form upon a sheet or screen placed for its reception. It will thus be seen that it is the duty of the condenser to collect the rays of light emitted by the jet as much as possible, and project them forward in a parallel form through the slide. Having become acquainted with the function of the condenser, it behoves us to consider the best form suited to the requirements of the lantern. As a single condenser would not answer properly, by reason of the spherical aberration arising from the necessarily short focus required, it is usual to employ a compound condenser, which is generally formed of a couple of plano-convex lenses, mounted close together in a metal cell, with the flat sides out, as shown in Fig 35, this arrangement giving a lens of short focus and good optical qualities. Although various other combinations have been suggested from time to time, it is yet doubtful whether there is any distinct gain in their use, with the exception of the condenser introduced by Sir John Herschel some years ago, in which a bi-convex and a meniscus lens are mounted in a cell together, similar to Fig. 36, with the concave side of the latter placed next to the source of light. Condensers of this form are undoubtedly the best for use with the limelight, but unfortunately there are but few houses now supplying them. In fact, at the present moment the writer can only call to mind one firm—Messrs. J. Ottway & Son, 178, St. John Street Road, London, E.C.

Generally speaking, the best form of condensers are those which, from their short focus, permit the transmission of a wide angle of light, and distribute this over the entire field of the disc, without one part of the screen being better lighted than another. The size of the condenser, of course, depends in a great measure upon the dimensions of the slides to be exhibited; and as the standard size for the latter is now universally fixed at $3\frac{1}{4}$ inches square, 4-inch compound condensers will be found the most suitable to employ. It must be understood that it is a distinct disadvantage to use a condenser larger than is absolutely necessary, as much of the light is thereby wasted; but, on the other hand, it should not be too small, otherwise the pictures will be insufficiently illuminated. In purchasing condensers, it is advisable to see that the lens coming next to the slides is entirely free from all defects, such as air-bubbles or striæ, as they are apt to show unpleasantly on the screen with some negatives.

It is advisable to have the condensers loosely mounted in their cells, otherwise the heat of the lantern may cause them to crack, and, for the same reason, the sudden expansion of the glass should be avoided by gently warming the condenser previous to the lantern being fully lighted up. A few holes in the periphery of the cell will permit the escape of any moisture which may happen to condense on the inner faces of the lenses.

It will be found a good plan to provide the collar of each stage-plate with a bayonet slot, for the purpose of holding the condensers more securely. To do this, file an L-shaped slot in the upper edge of the collar, and then insert the condenser, and mark the position for a small cheese-headed screw, which is then screwed into a hole, drilled

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and tapped for its reception, in the cell of the condenser. If the latter is now pushed into the collar, with the screw-head passing through the longer arm of the L-shaped slot, a slight turn to the right or the left will serve to secure it in position.

Although it is necessary to employ good condensers, it is of still greater importance to have first-class objectives, as the latter may truly be said to be one of the most important parts of the entire lantern, as the brilliancy of the pictures is, to a great extent, dependent upon the quality of the objective. The best form of lens for lantern use is, without doubt, the ordinary portrait combination of the photographer, which consists of a double convex and a plano-concave lens, ground in such a manner that the convex side of one lens can be fitted and cemented into the concave side of the other by means of Canada balsam, the front combination being a pair of similar lenses mounted together, with a slight air space between. A good lens of this form, while being achromatic, will possess sufficient depth of definition and flatness of field to be capable of giving very brilliant pictures on the screen.

An operator who is desirous of combining lantern with photographic work will find ordinary half-plate photographic combinations answer his purpose very well; but, on the other hand, the same person will do well to bear in mind that a lens made specially for lantern work is not always suitable for photographic use, as the visual and chemical foci are not coincident.

The better class of lantern objectives are now provided with several extra lenses of varying foci, mounted in brass cells, all of which fit into the same mount, and thus enable the operator to speedily effect a change of lenses, according to his requirements. By means of this arrangement, the exhibitor, after having erected his lantern in the most suitable position, can immediately show a six-foot or eighteen-foot disc by the aid of these interchangeable objectives, as they each have a different focus, and thus enable the operator, by a suitable selection, to obtain a larger or smaller disc, as desired, without altering the position of the lantern. It is also usual to fit the best lantern objectives with sliding shutters, or "flashers," as they are more generally called. These flashers are formed of hinged brass discs, which are permanent fixtures to the front of the lens mount, and replace the old-fashioned lens cap. By means of a rapid turn the flasher may be made to revolve, and instantaneously disclose the fresh picture, thus producing a very good effect with some slides. Fig 37 represents a lantern lens fitted with a flasher.

Briefly stated, the limelight is produced by allowing a couple of streams of oxygen and hydrogen gases (either separate or combined) to impinge upon a cylinder of unslaked lime, which is thereby rendered incandescent, and capable of emitting a most powerful white light whilst in this condition, the only requisites for the production of the light being the two gases and a cylinder of lime. The oxygen gas is made by heating a mixture composed of chlorate of potash and black oxide of manganese in a metal retort over an ordinary fire, the ingredients being mixed together in the proportion of two pounds of chlorate to half a pound of manganese. It may here be stated that the above quantity should be sufficient to produce about ten feet of gas, which will keep a blow-through jet alight for about a couple of hours. The chlorate of potash should always be of good quality, and obtained from a firm of repute, in order that it may be entirely free from all ignitable foreign matter whatsoever. The oxygen retort into which the mixture should now be put is usually made of iron or copper, in the form of a cone, as shown in Fig. 38, having a projecting pipe at the top or apex of the cone, for the purpose of carrying off the gas as generated, this pipe being connected by means of a piece of flexible tubing with a wash bottle (Woulff's bottle), containing water. This wash bottle is used for the purpose of cooling and purifying the gas, which is then conveyed, by means of tubing, from the bottle to the gas-bag. The retort, when charged with the mixture as above directed, is located over a good fire, or, better still, a Bunsen gas burner. When the gas is being given off pretty freely, it will be seen bubbling through the water in the wash bottle, and after having first allowed it to run to waste for a few minutes, the bottle should be connected with the gas-bag by means of another piece of flexible tubing. Before making the connection between the purifier and the bag, it will be necessary to flatten out the latter in all directions, in order to expel any air it may contain. Gas-bags are made of mackintosh-cloth in the form of a wedge of varying size, according to the quantity of gas they are intended to hold, and a small brass tap is fixed in the middle of the apex of the wedge, to afford an inlet and outlet for the gas. When two gas-bags are used, one for each gas, it is usual to paint a conspicuous O and H on the side of them, for the purpose of distinguishing the hydrogen from the oxygen. As oxygen does not keep well in a bag, it will be found advisable to make the gas a few hours previous to the entertainment, carefully emptying the bag afterwards.

Although pure hydrogen is always preferable to the coal-gas of the household supply (carburetted hydrogen), yet the lantern operator is generally glad to put up with the latter by the simple expedient of making a connection between the jet and the nearest gas bracket. Hydrogen gas can, however, be very readily made by the action of dilute sulphuric acid upon scrap zinc. For this purpose a large glass bottle is furnished with a good sound cork, to which is fitted a glass safety funnel and a delivery tube. The bottle is now half filled with dilute sulphuric acid and water, in the proportion of six of water to one of acid, which is poured down the safety funnel on to a quantity of clean scrap zinc cuttings lying about an inch deep at the bottom of the bottle, the latter being afterwards connected with a purifier and gas-bag, the same as before. The bags, when filled in the above manner, will be ready for immediate use, and as the gas needs to be forced through the jet under great pressure, the bag or bags should be placed between a single or double pressure board, on the top of which one or two heavy iron weights may be placed, for the purpose of obtaining the required pressure.

In using a blow-through jet and the ordinary coal-gas of the house supply, the pressure on the gas main will generally be found sufficient, and the gas may be drawn direct from the nearest gas bracket by means of a piece of flexible tubing attached to the jet; but with the mixed jet it will be advisable to fill a gas-bag from the main, and use it under pressure between double pressure boards, together with the oxygen bag, one set of weights furnishing the requisite amount of pressure for the two bags, as above stated. One hundredweight is the usual weight placed upon the bags, and although the pressure may be increased, if necessary, while the jet is burning, it is inadvisable to take off any of the weights without first turning off the jet tap, as it might cause the flame to be drawn into the bags, and thus lead to disastrous results.

Oxygen gas is now obtainable commercially at a very cheap rate, compressed into portable steel cylinders. These cylinders, when filled with gas, can be kept for any length of time, and used as required, no weights, pressure boards, or bags being needed. Although with careful use the valve or tap of a cylinder may be gently turned on and the gas used direct, this course is not to be recommended, as the gas, being under a considerable pressure, is apt to come with a sudden rush and blow out the jet. And then, again, when the bottle has been partially emptied and the pressure thereby reduced, it will be necessary to frequently open the valve more and more, otherwise the light of the jet will be found to diminish; hence the desirability of some means of regulating the outflow of the gas, and thus ensuring an even pressure until the cylinder is exhausted. This want is supplied by the use of an automatic regulator, which takes the form of a miniature bellows enclosed in a metal box, and capable of being screwed on to the delivery tube of the cylinder. Upon the valve of the cylinder being opened, it causes the bellows to fill with gas, and when filled, an archimedean screw automatically closes the orifice of the gas inlet tube until the bellows are emptied, when the inlet is again opened and the same action repeated. The regulator, in reality, performs the part of a miniature gas-bag, from which the jets of the lantern are supplied direct.

With regard to the selection of a suitable jet, it will be advisable to describe two different kinds, and leave it to the reader to select the one most suitable to his requirements. The blow-through or safety jet (which is so called on account of its being easily managed by the inexperienced beginner) is the simplest form of jet that can be used for a triple lantern. In construction, this jet consists of a couple of metal tubes, one for the oxygen and the other for the hydrogen, placed parallel to each other, with the mouth of the hydrogen tube in a vertical position, and the extremity of the oxygen tube bent over in such a manner that the gas from the latter is driven through the hydrogen flame on to the lime cylinder, supported upon an adjustable pin behind. The best make of jets are fitted with a lime turner, which takes the form of an extended handle placed parallel with the gas delivery tubes, a cog-wheel arrangement near the mouth of the jet furnishing the requisite motion for turning, raising, or lowering the lime. A cheap reliable jet, which is known to opticians as the "Optimus" blow-through jet, is shown in Fig. 39.

The general construction of the mixed jet is somewhat similar to the above, with the exception of the burner, which is provided with a single delivery tube curved in a suitable position to direct the gases full upon the lime. The two gases are conveyed by separate tubes until they arrive at a small chamber at the base of the burner, when they become mixed, and are directed upon the lime in this condition, the mixture of the gases considerably enhancing the power of the light. Fig. 40 shows a very useful form of this jet, which is interchangeable, enabling the operator to remove the single delivery tube of the burner and

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substitute the double tubes shown at A, thus turning it into a safety jet.

This jet will be found very useful for exhibitors who prefer to use the blow-through jet for ordinary purposes, and may occasionally desire the more powerful light of the mixed jet.

Although it may be said that any form of jet is quite safe if carefully used, yet the blow-through is undoubtedly the best for the use of the amateur or beginner, as, besides its simplicity, it only requires the use of one bag or cylinder of gas—namely, the oxygen, as the hydrogen can be drawn direct from the nearest gas bracket. The principal danger arising from the use of the mixed jet is due to the fact that the mixed gases are of a highly explosive nature, and should the pressure upon the bags be inadvertently withdrawn for a moment, it would have the effect of drawing the flame into the bag, thus causing an explosion of a more or less serious nature.

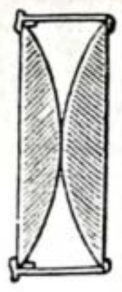

Fig. 35.

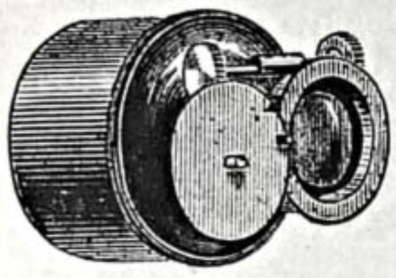

Fig. 37.

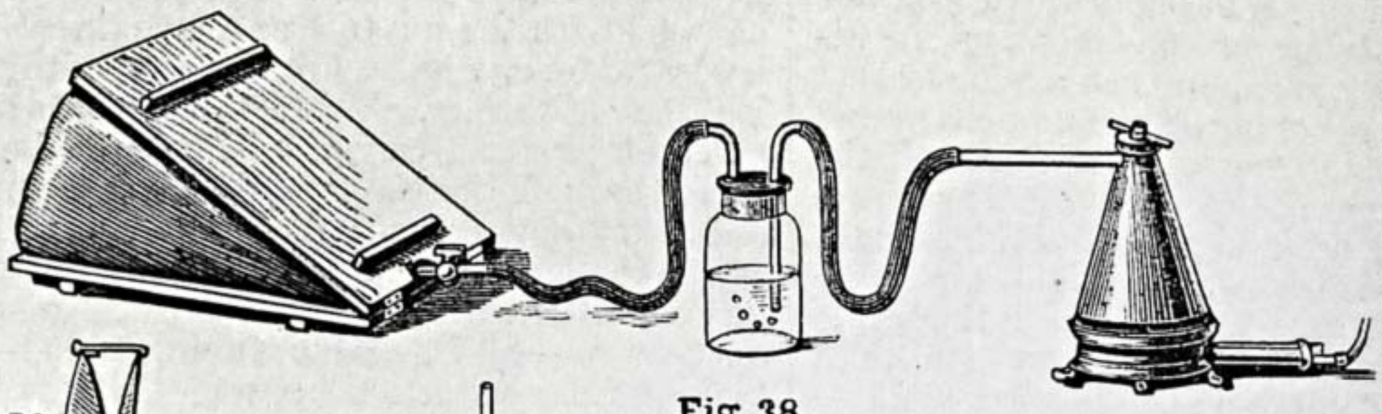

Fig. 38.

Fig. 36.

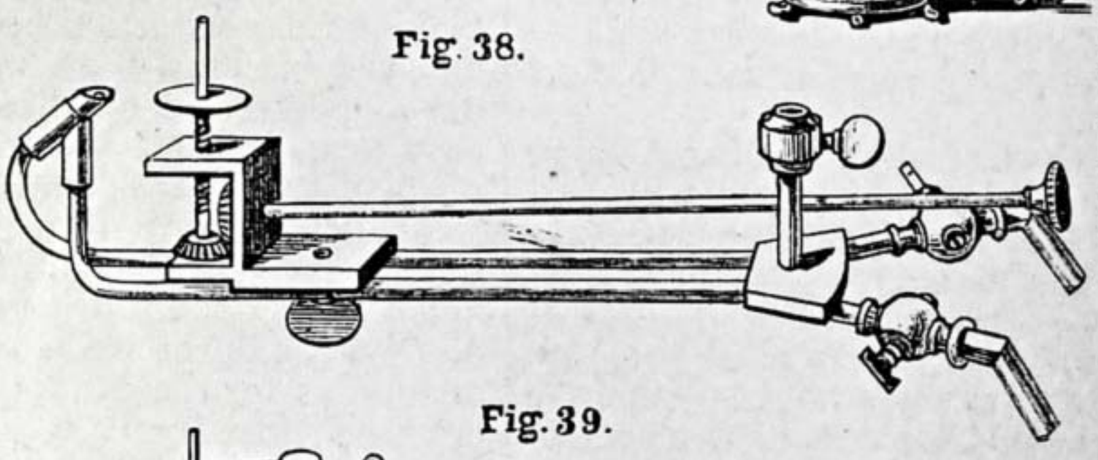

Fig. 39.

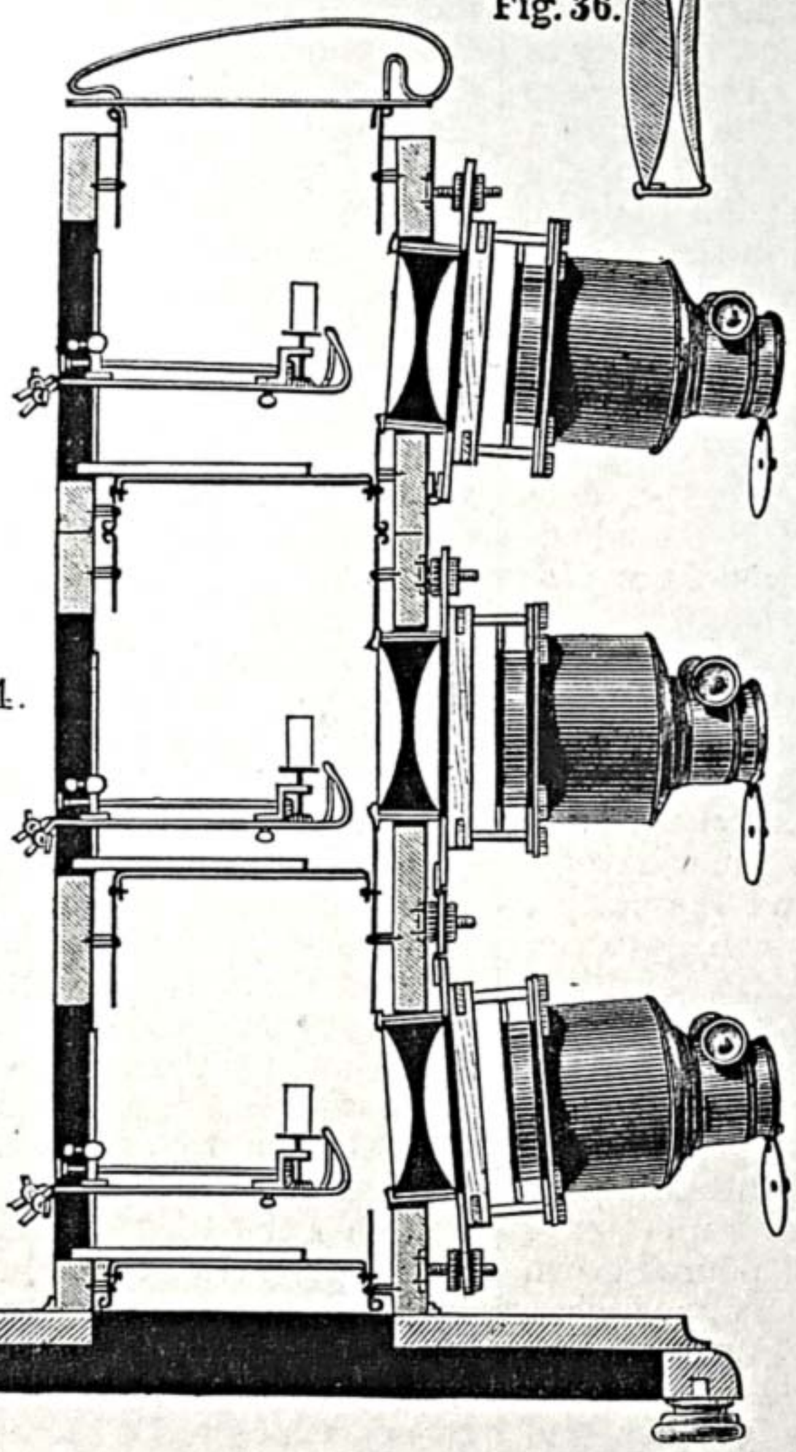

Fig. 44.

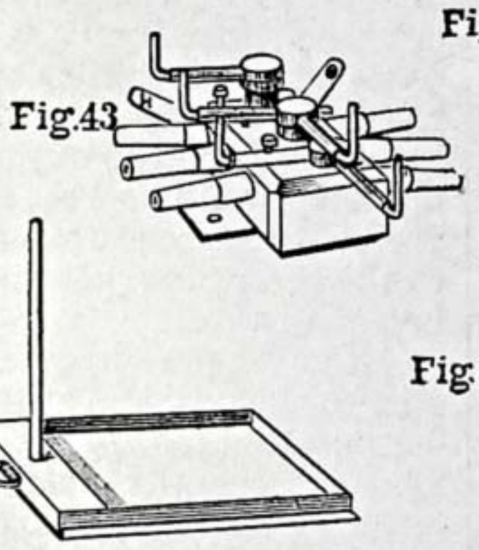

Fig. 41.

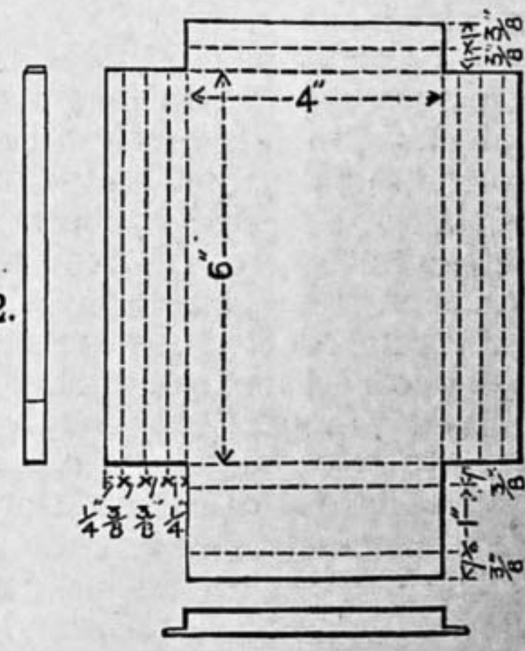

Fig. 42.

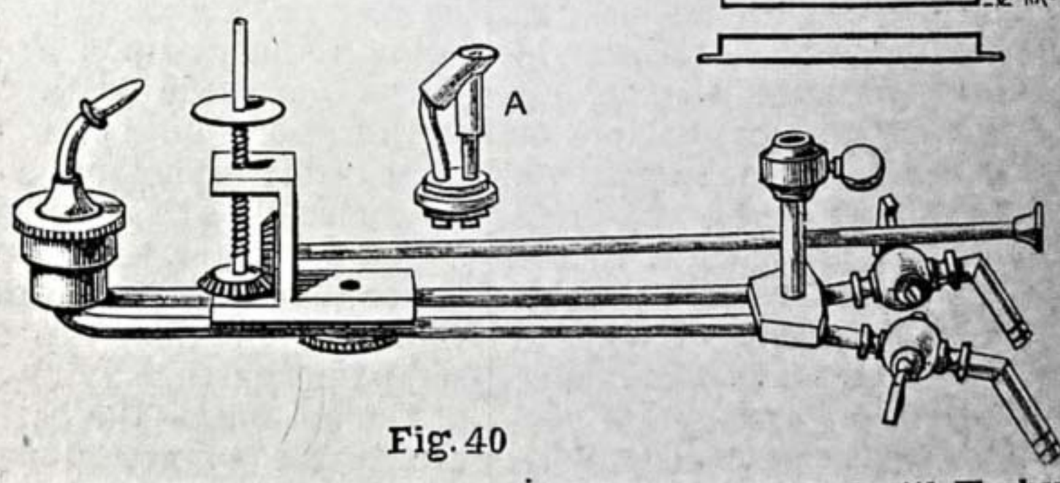

Fig. 40

Fig. 35.—Plano-Convex Condenser. Fig. 36.—Meniscus and Bi-Convex Condenser. Fig. 37.—Lantern Lens fitted with Flasher. Fig. 38.—Arrangement of Retort, Purifier, and Gas-Bag. Fig. 39.—"Optimus" Blow-through Jet. Fig. 40.—"Optimus" Interchangeable Jet. Fig. 41.—Jet Tray. Fig. 42.—Plan and Section of ditto. Fig. 43.—Triple Dissolver. Fig. 44.—Section of Triple Lantern, showing Internal Fittings and Arrangement.

Suitable jets having been provided, they must now be fitted to the lantern by means of a metal tray, which is furnished with an upright stem at one end, the socket of the jet being intended to fit over this stem of the tray, to which it is secured at any desired height by means of a small milled screw which grips the stem. There will be no occasion for the operator to buy these trays, as they will not be very difficult to make. Fig. 41 represents one of these trays, of which we shall require three, each one being separately fitted to slide along the grooves of one of the jet shelves of the lantern. The simplest plan to adopt in making these trays will be to cut a piece of moderately thin sheet brass to the form of Fig. 42, and then bend and hammer the metal into shape along the dotted lines, afterwards hard-soldering together the four corners of the turned-up sides. For each tray a sheet of brass, 9 in. by 7½ in., should be cut according to the plan and measurement shown in Fig. 42. First mark out the inner rectangle, measuring 6 in. by 4 in., to form the floor of the tray, then draw lines parallel to the length of this to form the two sides, dividing each of them into three ⅜ in. and two ¼ in. portions, as will be seen in the cut. The back of the tray, which is the full width of the floor, measures 1 in. in the middle, with ⅜ in. on either side; and the front end, which is also the width of the floor, is to be divided along the centre into two ⅜ in. portions. When cut to the required form, the metal must be sharply bent along all the dotted lines by being carefully hammered over the edge of a stake until it presents the lengthwise and cross sections of Fig. 42, after which the four corners are hard-soldered together in the usual manner. For the supporting rod of the jet a 5 in. length of ¼ in. round brass rod may be soldered into a hole punched through the raised shelf at the back of the tray, and a small handle can be readily formed by turning up a short length of brass wire into the form of a triangle, and then springing it into a ½ in. length of tubing of suitable size, which should be soldered to the back of the tray. During construction, each tray must, of course, be occasionally tried in the grooves of its respective shelf, in order that it may be made to move quite smooth, without any jerky motion. The limes required for lantern purposes are cylindrically turned pieces of unslaked lime, each one being pierced with a hole, which enables it to be placed upon the lime-pin of the jet. As moisture or damp spoils the limes, it is necessary to keep them in a tightly corked bottle.

In use, it is requisite to occasionally turn the lime as it becomes pitted by the action of the jet, and in order to do this readily it will be found a great boon to have the jet fitted with a lime-turner, as illustrated in Figs. 39 and 40. The most reliable limes in the market appear to be the "Excelsior," as this make seems to be uniformly good.

The dissolving effect of the modern lime-light lantern is now produced by means of a specially constructed tap or dissolver, by the use of which either of the lights may be raised or lowered according to requirements, by simply turning the handle of the dissolver, this action serving to cut off the gas from one jet at the same time that it turns it on full to the other. A triple dissolver is naturally a rather expensive appliance, by reason of the complicated arrangement of tubes required, the "Optimus" triple dissolver, at 38s. (see Fig. 43), being one of the cheapest at present sold. It is by no means absolutely indispensable that a triple dissolver should be used, as very good results can be got by the employment of a six-way tap attached to the twin instrument, and a four-way tap to the top lantern.

As a triple lantern is a somewhat heavy instrument to lift, it is usual to provide a couple of brass rails or handles, which are screwed one on either side of the woodwork, at the upper portion of the twin lantern. Some operators screen the light emitted from the jets by having a black velvet curtain hung by means of rings from a brass hoop, which is fitted into a couple of small sockets screwed one on either side of the back of the lantern body. Fig. 44 is a section of the lantern, showing clearly the arrangement of the interior.

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When quite ready to light up, a sufficient length of rubber tubing should be brought from the hydrogen bag or the nearest gas bracket, and connected with the hydrogen tube of the dissolver, the latter being connected by shorter lengths of tubing with the respective jets. A lime may now be slipped on to the lime-pins, and the hydrogen side of all the jets lighted up a little, with the dissolver taps placed so that a small flame is burned in each lantern, in order to gradually "warm up." Another piece of tubing is now brought from the oxygen bag or bottle, and is attached to the oxygen tube of the dissolver, care being taken to tie all the rubber tubes on to the connections with string. The taps may now be gradually turned on to their full extent—the hydrogen first, and then the oxygen—and as soon as they are all burning properly it will be necessary to see that the bye-presses for the oxygen act all right when the dissolver is turned off. When the jets are found to be working satisfactorily it will be time to see and adjust the light upon the screen, moving the jets up and down and from side to side until each disc is seen to be equally illuminated all over, the three discs being finally made to register correctly on the screen by means of the set-screws attached to the stage-plates. The above description of the working of the lantern is necessarily brief, and those who desire further information should consult one of the many excellent manuals on the management of the optical lantern. A very useful little booklet, containing a vast fund of information on lantern matters, is published by Messrs. Perken, Son and Rayment, of Hatton Garden, London, at the low price of 6d.

For home use, where portability is not an object, it will be found useful to have a paper screen mounted on a roller, similar to a map, a screen of this description presenting a much smoother and whiter surface than it is possible to obtain by the use of linen. When, however, it is requisite to employ a screen which will pack into a very small compass, it is better to have one made of a material known to lanternists as "union cloth." The screen can generally be suspended from a cord stretched across the room in which the exhibition takes place by means of a couple of steel eyes or staples; or, better still, it can be hung against the wall from a picture rod. In either case, however, a cord should be attached to each of the lower corners for the purpose of steadying it. The majority of operators prefer to have the screen mounted on an iron or wooden stand by itself, which can readily be carried about from place to place, and may be speedily erected or taken down without disturbing any of the surroundings.

In conclusion, the writer may add that any reader wishing for further information upon any matter relating to the lantern can rely upon his assistance through the medium of "Shop."

CLOCK CLEANING AND REPAIRING.

BY A PRACTICAL HAND.

MUSICAL CLOCK—CLOCK SHOWING TIMES OF ALL NATIONS—CHIMING CLOCK.

Musical Clock.—To make, say, a long case eight-day clock, purchase the works of a large musical-box whose case is destroyed; if it works a little out of order, repair it, (for instructions, see Vol. II., page 23), and then screw it to side of clock below movement, clear of pendulum. Solder on to the hour axle—say at 9, 12, 3, and 6 o'clock—four wires to just raise a small lever you attach with screw to one of the clock plates, and from it have a wire which will draw away from the fan of musical-box; it will then play one tune through and change every time if you leave the change part set. At the next three hours period it will play again, and so on till ten or twelve tunes have been gone through, when you re-wind the box or leave it silent, as you desire. You can do the same with a small musical-box and small clock.

Clock Showing Times of all Nations.—A timepiece showing times of all nations is made thus: Fix in centre a dial of large size, with room for, say, six or eight smaller dials around. You now only require broken movements, with dial wheels placed at equal distances from centre stud, which have all to turn on this barrel; inside affix a large-sized wheel with small teeth, so as to turn the other six or eight dial wheels on the front dial; make the smaller ones with hands to fit, and set them according to the tables thus: New York five hours behind

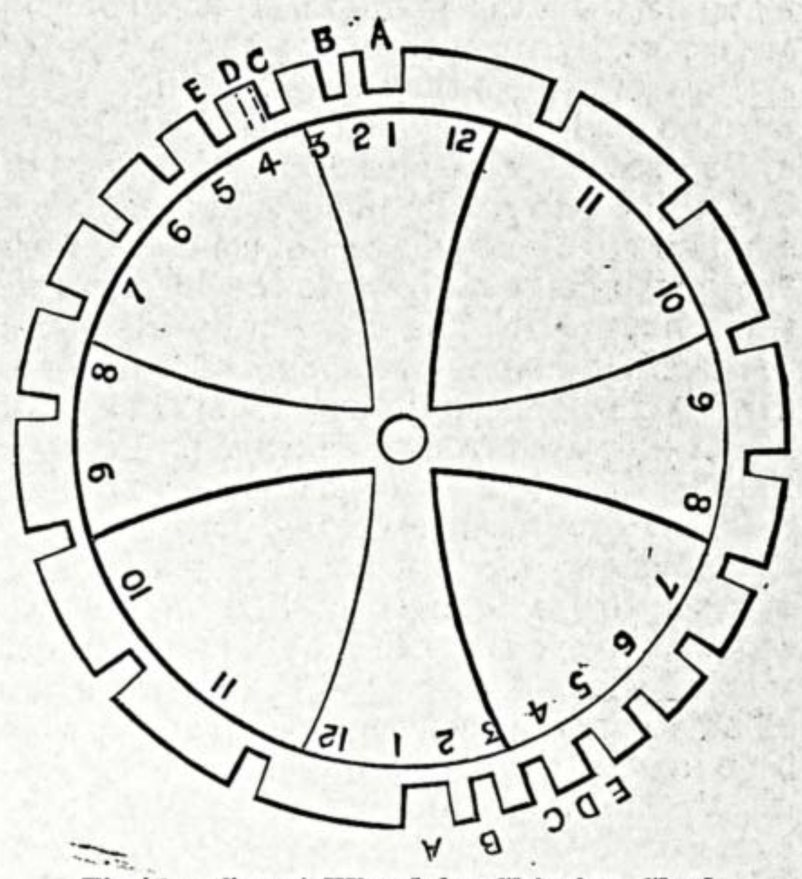

Fig. 1.—Count Wheel for Chiming Clock.

Greenwich time, shown by the centre large one, etc. They will all turn correctly, and at a glance show to the most ignorant the times of the places chosen.

Chiming Clock.—I will now describe a chiming clock I made, similar to those that may be seen in London and some of our great cities—it chimes on the two bells, and strikes the hours on the large ordinary one. This is a figure of Father Time striking the large bell, and two sailor boys the smaller ones. The quarters are more easily distinguished than those at Westminster or Cambridge by their simplicity. Any reader with a little mechanical skill can fit one up to an ordinary clock. Procure an old eight-day American spring clock movement—there are lots at the marine stores for 1s. or so; generally the pallet and pendulum are gone, but these are not required. Take the clock to pieces, and if the striking part is complete, you have only to alter it. Put the two plates together, and about ½ in. from the holes where the hammer works, drill a hole through both plates for a second hammer, and make one like it, but with a longer arm, say 1½ in. longer; cut the lifting part a shade longer, so that as the original hammer drops the other is lifting. Now put the hammers in, and striking wheel and stop wheel; try with your finger if they drop one after the other—if so, that is as it should be. Now procure two bells or two gongs—as you may prefer; try the tones heavy and light, then so place them and screw to case that the last falling hammer hits the heavy tone; you can bend the wire arms any way to hit the bells right. Now take the minute wheel of your other clock, with the small lever to lift striking part at each hour; solder on or drill three similar levers one-fourth the way round axle, but behind the one that strikes the hour, at equal distances from the one already on; the reason of placing the three behind being that they may not interfere with the ordinary hour lever. They will lift at quarter past, half past, and three-quarters past the hour, but the unoccupied fourth of axle having no lever will not chime: this will be at the hour, and its own hour lever will act. It is not necessary to chime then and strike: you can make it do so, but it will be more trouble to make the count wheel act. Now take the count wheel of the extra works for chiming, and solder pieces on, and cut fresh notches as required. The spaces A, B, C require nothing; next cut out D with C the same width as A; leave a part uncut the same size as that betwixt A and B. Now solder up the other open spaces halfway round until you come to A, B, C again, then repeat what you have done in the first half. Now mark out openings and standing pieces A, B, C until you come at A, B, C again, and you will find them fit, so the finish will be just where you commenced. To be more certain that you have cut them right, place wheel in frame, and the counting lever and the striking wheel; now, if you make it strike as you go along the cutting, you have not done wrong. After first chime A, B, C is right, cut extra piece out at D so that it will strike one; leave piece standing to strike one again, and the other one to make two, or the half-hour chime will be struck as the lever falls into E; repeat all round the inside figures at which it used to strike. Now put your bells on the board on which you have fixed the works, and let it chime all round; thus it will do twenty-four quarters before wheel goes once round. Now arrange a lever wire inside the ordinary clock-case in which you will fix the chiming, so that it will lift your chiming stop lever as the going part did when the works were perfect—I refer to those you have altered; it is somewhat troublesome, but it is worth while, especially at so trifling a cost. Full chimes are very costly; but the above is inexpensive, and will suit an amateur well.

Cleaning Dials.—Some may have an old clock or barometer with a shabby dial, which may be re-silvered and lacquered thus:—Unscrew the four ornaments at the corners, then polish them with emery (fine quality), and next apply brass polish sold in tin boxes; now clean it off, using dry rotten-stone very fine and a clean wash-leather; next, without soiling surface, place it upon a stove, so that you can scarcely handle it for heat, then apply best quality lacquer with good camel's-hair brush; lay it on in straight strokes, as it dries very quickly; but you will soon get into the way.

Now clean the corner pieces by placing in nitric acid of the strength of one part acid and three water. Leave it in this bath two hours, then wash it in clean water; scour with stiff brush, sand, and water; now rinse well in clear water. Next take pure nitric acid, dip the corner pieces into this and out again at once, wash again, and dry in hot sawdust (fine); now lacquer as before, heating first. The following is a recipe for pure lacquer:—One gill of rectified spirits, half an ounce of turmeric powder, one drachm of arnotto, and one drachm of saffron; let

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these stand ten days in a warm place, shake every day or so until all is finally dissolved, then filter through muslin into a clean bottle; in doing this the greatest care is required, as the least dirt shows. Add now one and a half ounces of seed lac, and again leave the mixture ten days, shaking as before; let it settle now, and it is ready for use.

Re-silvering Dials.—To silver clock and barometer dials, take nitrate of silver 25 grains, cream of tartar 30 grains, common salt ½ oz.; mix thoroughly. Now mix a part of this powder with distilled water. Having cleaned the dial well as before stated, take a good-sized cork covered with lint, and apply the mixture; when well covered, gently polish with clean lint, and protect with a coat of crystal varnish. If you desire to make the varnish, take pickled mastic 1 oz., rectified spirits 5 oz., animal charcoal ¼ oz.; digest and filter, well shaking the bottle.

OPENING OF THE "WORK" EXHIBITION.

THE following verbatim report of the proceedings at the opening of the "Work" Exhibition on December 29, 1890, at 2 p.m., in the large Hall of the Polytechnic Institute, Regent Street, London, W., by the Rt. Hon. Sir John Lubbock, Bart., M.P., is given to meet the wishes of many readers of WORK in town and country who were not able to be present at the ceremony. Sir John Lubbock was accompanied by Lady Lubbock, and among those present on the platform were Sir Lyon Playfair, M.P., Sir Philip Magnus, Mr. Wemyss Reid, Mr. H. O. Arnold-Forster, Mr. Francis Young, Editor of Work, Mr. R. Mitchell and Mr. J. E. K. Studd, of the Polytechnic Institute, etc., etc.

SIR JOHN LUBBOCK, in addressing the assemblage, said:—Mr. Arnold-Forster, Ladies and Gentlemen,—I think I may very fairly congratulate you on the interesting Exhibition which it is now my privilege to open. We owe it mainly to the energy and enterprise of Messrs. Cassell & Company, to whom we are indebted in so many ways. I believe that the happy thought rests with the Editor of WORK, and for the satisfactory condition to which the Exhibition has been brought we are, of course, indebted to Mr. Harland, who has been good enough to act as secretary to the Exhibition. You will see it is one of very great variety. I have made a little list of some few of the things which are to be seen in the rooms. The exhibits amount to more than a thousand, and of course I shall only mention a few of them. In woodwork, which constitutes a very large part of the Exhibition, there are cabinets, screens, brackets, frames, panels, candlesticks, tables—in fact, furniture of all kinds. Then in metal-work—another very important branch—there are arms, guns, swords, and a great variety of tools—planes, saws, centre-bits, lathes, photographic cameras, galvanometers, induction coils, and steam engines. In another branch, no less important, are designs for stained glass, tiles, panels, fire-escapes, iron gates, dynamo engines, automatic signals, and gas engines. Again, there are to be seen specimens of lithography, printing, bookbinding, wood engraving, maps, a quantity of needlework, a great variety of articles of dress, terra-cotta vases, flower stands, and pottery; a number of exhibits of leather work; and a great variety of miscellaneous objects, including bird cages, aviaries, boats, bats, telephones, jewellery, musical instruments, besides a number of domestic appliances for economising labour and minimising danger, as, for instance, by the provision of self-extinguishing and non-explosive paraffin lamps. The exhibitors come from all parts of the country, including several from my old constituency of Maidstone. The competitors, I am glad to see, moreover, come not from England only, but from Scotland and Ireland, and from our colonies, even distant colonies like the Cape, and also from foreign countries. The exhibitors are men and women, old and young, some being boys and girls as young as twelve and fourteen years of age, and one (Jackson) is an old man of eighty-nine, who exhibits a ship and shows how to sail it. Rich and poor are among the exhibitors. Mr. Twist, an unskilled labourer at the Docks, exhibits a beautiful Smyrna rug from his own design; and Mr. Collins, a moulder, shows a pianoforte entirely of his own construction. For the first time, I am informed, in adjudging prizes, a distinction has been made between the exhibits of persons who are especially engaged in the production of articles of which they send specimens, of masters and journeymen, and the exhibits of the second class, for apprentices, and of the third class, for amateurs; so that amateurs will not have to compete with those who make such work the business of their lives. In this Exhibition amateurs predominate, and even skilled workmen exhibit in lines different from those in which they are primarily engaged. Perhaps this is the greatest collection of hobbies that has ever been seen, not that I would say anything against hobbies, which add so much to the interest of life. While we cannot hope to emulate the achievements of some of the exhibitors, yet the objects made by amateurs are such as anyone of us, with time and application, might hope to produce. The large number of exhibits sent by English workmen is a very satisfactory feature of the Exhibition. No workmen in the world are more anxious to improve themselves than our English workmen. It is some satisfaction that most of the strikes of the present day are not so much for increased wages as for increased leisure in which to effect self-improvement. I have always been of opinion that our system of education is too bookish, and that it might be much improved by more attention and more time being devoted to manual instruction, not only in our elementary schools, but in the great public colleges, and even in the universities. But at the same time, I am not one of those who are afraid of education upon that account; and I think that anyone who had the impression that education had tended to prevent people from using their hands, would have his fears considerably mitigated by going carefully through the different departments of this Exhibition. It is, no doubt, a very great mistake to suppose that clerical work is necessarily of a higher order than hand work. We do not, indeed, apply this test to painters or sculptors, and why, therefore, should we apply it to other walks of life? We all remember the story of Northcote the painter when he was asked how he mixed his colours—"With brains, sir, with brains." And such work as we see here is in reality brain work as much as, and even more than, hand work. It is, I am sure, a great evidence of thought having been devoted to the objects which have been produced. A very charming writer, whom we have unfortunately lost (Mr. Jeffries), very truly says, in one of his books: "If anybody imagine they shall find thought in many books, certainly they will be disappointed. Thought dwells by the stream and sea, by the hill and the woodland, in the sunshine and free wind;" and he might have added that thought is also to be found in the workshop.

Those who are exhibiting here, will have found that the production of the articles they have sent has been a great pleasure and advantage. The boy or man who makes something for himself finds that he must think and exercise his reason. He is brought in contact with the forces of Nature, and he is compelled, in order to apply and control those forces, to devote some thought and study to the laws of Nature; and from thence he is almost irresistibly led up to the phenomena of mind. The greatest literary authorities have always cordially recognised this.

"Man," said Carlyle, "is a tool-using animal. He can use tools, can devise tools; with them the granite mountains melt into light dust before him; he kneads iron as if it were soft paste; seas are his smooth highway, winds and fire his unwearying steeds; without tools he is nothing, with tools he is everything." But besides the advantage to the exhibitors themselves, we hope and believe that such exhibitions as this tend to develop and promote our commerce, and especially our manufactures. Who can tell what discoveries are awaiting us? One of our great statesmen said, the other day, that we could not hope in the next half century to see discoveries as marvellous and as far-reaching as those made in the last fifty years. But I should venture very humbly to differ entirely with him in that respect. As we widen the circle of knowledge, the chances and the prospects of discoveries become greater and greater. And, on the other hand, those who have been trained to take advantage of their opportunities are also far more numerous than they were fifty years ago. I for one, therefore, should be disposed to hope that, so far from the next fifty years being less fruitful of discoveries than the past half century, the very opposite will be the result.

And how very simple many of the most far-reaching discoveries really are! Just look, for instance, at the inventions of Sir Henry Bessemer. The saving to mankind from Sir Henry Bessemer's discoveries in the manufacture of steel sounds almost fabulous. Steel rails have, to a great extent, taken the place of iron rails, and the former are said to last twenty times as long as the latter. Yet what was his invention? It consisted mainly in blowing air through crude melted iron for a quarter of an hour. Look again at coal mining. Formerly, the coal was carried up a ladder; then it was taken to the fireplace of the manufacturer in a basket on a man's back. Then occurred the use of pack horses, then the use of the cart, then the use of rails with horse power, and then the use of steam. With the basket, a man carried a half hundredweight; the pack horse three hundredweight; the cart sixteen hundredweight; the rails and horse-power, forty hundredweight; and steam, forty tons. Just see what enormous progress there is, and yet how very simple each step is. In fact, everyone of us may hope to add something to the store of human knowledge. There is no single substance in Nature of which all the properties are yet known to us, and we do not make half the use we might of the forces of

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Nature. But we continue to make progress. I hear that a Scotch firm have taken the Volcano of Stromboli, which they have rented for the purpose of using it as a natural chemical laboratory. In this Exhibition there are many ingenious suggestions, and I cannot doubt that many of them will prove useful and fruitful in the future. It is wonderful to think what our machines already do. It has been calculated that the machines of this country alone, of this island, so small a part of the world, are capable of doing as much work as the whole human race put together. In fact, Emerson has very justly said that, as far as he could see, "steam is really half an Englishman." It is not so contradictory as might at first appear, to apply the word "manufactures" to things made by machinery, because the hand is, after all, the finest and most delicate machine in the world. And even in things which, so to speak, are made by machinery, the hand, after all, has no small part. To do anything well, hand, mind, and machine must all work harmoniously together, and both in this respect, and in the intelligence and character required, we shall, I feel satisfied, come to appreciate more and more the dignity and usefulness of manual labour. It is because I believe this Exhibition is calculated to take us a step onward, and in the right direction, that I have very great pleasure in tendering, as I think I may do in your name, our thanks to those who have taken the most active part in its preparation, and in now declaring this Exhibition duly opened.

MR. ARNOLD-FORSTER : — Ladies and Gentlemen, — As a representative of the Company which has had the privilege of organising this Exhibition, I think you will agree with me in the vote which I intend to propose. I have no hesitation in saying that you will all agree with me in feeling that the compliment which has been paid to the organisers, and to those who have taken part in this Exhibition, or to those who have shown their interest in its objects, by the presence of the Chairman of the London County Council and President of the London Chamber of Commerce, is no ordinary compliment; and, if that boon could be increased, it has been increased by the speech which Sir John Lubbock has just made to us. Speaking on behalf of Messrs. Cassell & Company, I may say that we feel grateful for the compliment which Sir John Lubbock has paid us. We are, of course, like a great many other manufacturing institutions, a manufactory established for the purpose of stereotyping and recording the thoughts of people wiser than ourselves, and distributing them throughout the world. But I can safely say —speaking as one who has taken some part in this business—that this is a side to our business which is not common to other great manufactories. Compare it, for instance, with the manufactories which turn out so many thousands of bushels of tin tacks, or so many thousands of yards of linen sheeting, and you will find that it is replete with ever-varying and intense interest; and it is of great value to all of us who are engaged in it to feel there are men taking a leading part in the scientific, political, and municipal work of this country who recognise that we are endeavouring to do our best to carry on what has for a long time been the original tradition of our House—that of bringing the best works within the means of the largest number of people in this country. It is a gratification we do not often get in our trade, to be allowed to come face to face with the people whom we serve. Therefore, I look upon this occasion as rather a special one, and as giving us—me and those with me engaged in the actual work — an opportunity — which we are pleased and proud to possess—of meeting face to face a very large number of those whom we are able to provide with material for the informing of their minds. I hope I may be permitted to ask a very well-known and very distinguished friend, who is on the platform, to say a word or two in seconding the resolution which I now propose, of a cordial vote of thanks to Sir John Lubbock for the part he has taken here this afternoon. I ask Sir Lyon Playfair to address to the meeting a few observations in seconding the resolution.

SIR LYON PLAYFAIR, M.P. :—Ladies and Gentlemen,—All those of you who have read Messrs. Cassell's interesting periodical, WORK, will agree that it was a very happy idea to enable the encyclopædic contributors to that publication to show what they can do with their own hands. It is a periodical embracing a marvellous number of subjects, and giving a most accurate and full description of the matters with which it deals, and it is one to which I have often had occasion to refer. My right hon. friend, Sir John Lubbock, quoted an interesting passage from Carlyle. Now, Carlyle was a mental philosopher, but he was not an industrial man, or I do not think he would have used the definition that the characteristic which distinguished man from all other animals lay in his being a tool-using animal. The fact is that man is very singularly deficient in naturally born tools. If you look at the lower animals you will see they are often born into the world provided with the most admirable tools for the work they have to perform. The spider is the best of all weavers, and has admirable tools within itself for performing that work. The beaver is a capital engineer, and makes bridges, and the tools which it possesses are admirably calculated for the work it has to perform. The great friends of my right hon. friend, the ants, which build their cells and their store-houses, and show such a wonderful sagacity in the work that they are destined to perform, have admirable tools to work with. So have the bees, which have also received the attention of my right hon. friend. The bees are also capitally fitted with tools for their purposes. The tailor bird can sew; the silkworm can spin; the mole can make tunnels, all with appropriate tools. But only consider what a position man is in. Man is born into the world in such a way that the other animals that work with tools would, if associated with him, look upon him with the greatest contempt. Only think of a new-born baby! If you got together an inquest of the other animals upon that new-born baby, and they found that it was not even protected with the covering of the crust-shell, like the lobster, or like other animals of earth and air, with furs and feathers, they would decide at once that it was a miserable little thing, that it had no business in the world at all, and that it was not fitted for the struggle of life. But though he is as naked as the earthworm, he has an intellect far above all animals. How is it that an animal, possessing none of the tools necessary for work, comes to be such a great tool-using animal as it ultimately becomes? It is not the tools which teach him to work. It is the brain and intellectual development of man which enable him to perform the work that is necessary for his existence, sustenance, and propagation through the world. I used to define man as a fire-using animal, for no savage has been found in so low a state that he did not know how to make and continue a fire. But I begin to doubt —not very much to doubt—whether it is a good definition now. The definition is that man is distinct from all other animals by being a fire-using animal. You never find any other animals using fire. You may find monkeys surrounding and warming themselves at a fire made by man, and one of them, perhaps, running away with a burning brand, but you will never find it apply the brand to dried leaves or to woods in order to propagate the fire—unless we are to believe the astonishing, and, to me, incredible, statement of Emin Pasha, that he found chimpanzees making long processions in the woods, and lighting their way with torches. I have great respect for Emin Pasha, and what he has done, but I want verification of that statement. Even if it is true, it is the only instance where a lower animal has used fire in any history which we possess. It is the brain of the man which enables him to use fire and to apply it to industrial purposes. There is one thing in which we have gone back very much in industrial art, and that is—that the great division of labour has prevented men from getting an intelligent and intellectual knowledge of their work. Formerly, men were apprentices to the whole trade. The ancient guilds, which abound so much in London, used to exist in other parts of the country, and they were really universities for giving technical education. In the old charters of the guilds, the only word which is used in defining them as an institution was that they were founded as a *universitas* —as a university. They were really a university of technical education. The apprentice was taught his whole trade. He was, by his connection with guilds, made ambitious with regard to his trade. He wished to become a good workman, and under the rules of the guild he required a technical knowledge of the industry in which he was to work. Even with that knowledge of his entire trade he was not made a full workman. Afterwards he had to become what is a mere name now, but was then a reality —a journeyman. That is to say, he was obliged to make journeys all over the kingdom, and to work with his own hands in different parts of the country, seeing the different kinds of industry to be found therein—when I was a student in Germany, many years ago, I used to meet these "journeymen" on the roads and talked with them about their training—and then, having finished his time as a journeyman, he became a real workman. Now all this is lost to us. The division of a trade has become so great that a man may be engaged in one department of it his whole life. Suppose he is in the pin-making trade: he does not know how to make a pin. He may be engaged his whole life in pointing the pins, or in putting on the heads, or in drawing out the wire for the body of the pin, but he never makes the whole pin. So in other industries. He does not acquire an intelligent knowledge of the art or industry in which he is working. And what is the meaning of this Polytechnic Institution with which now I have the honour to be officially connected? What is the meaning of all the classes? Why do regular tailors come here to learn tailoring? Why do you get watchmakers here to learn watchmaking? You have bricklayers coming here to learn the

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art of bricklaying and the use of ornamental bricks. Why do they come here? They come here because they want to improve their intellectual position as workmen by having an intelligent knowledge of the industry in which they are engaged. That adds to their dignity as men and to their efficiency as workmen. They do not want to be confined to a mere corner of their industry. Industries are continually altering. Some day a method will be found of doing by machinery the work in which they are engaged, and if they do not know the whole of the industry, and are unable to adapt themselves to the altered conditions, they will be thrown out of employment; but if they possess that knowledge, they will be in a position to adapt themselves to the new circumstances. For instance, take the case mentioned by Sir John Lubbock just now—that of Bessemer steel. By this process thousands and thousands of men were thrown out of the old occupations of puddling iron, because iron does not now require puddling to make steel. If men know their particular industry in an intelligent way, they can apply themselves easily to new modifications which may be made. That leads me to what is desirable in an exhibition of this kind, and why I came here—not to speak, for I did not know I was to speak when I came on to this platform. Why I came here is—that I meant to recognise the fact that an exhibition of this kind shows to us the just pride of men who exhibit to us specimens of their best work. It also leads to the public recognition of that work, and encourages workmen to entertain honest pride in their handicraft, to understand that craft, and to use the best efforts of their brain in improving it. Every man that produces a good piece of work is a benefactor to the community. If he shows pride in his work, and improves it, or, by his invention, improves its method of production, he is a most important benefactor to the community. And, therefore, I think all exhibitions of this kind should be encouraged, and I am sure that you will feel grateful to Messrs. Cassell & Co. for having given an opportunity to the contributors to their journal of WORK to show what they can do by themselves, and in what manner the industries which they represent can best be improved. There is one thing more in which I am sure you will agree with me. My right hon. friend, Sir John Lubbock, is Chairman of the County Council; indeed, he is chairman of so many things that it would require a census to enumerate them. He undertakes so many things, and does them all so well, that the compliment is all the greater to you that he should have found time in the midst of his many avocations to come and give us such an excellent address this day, and to have declared open this Exhibition, which I hope will be attended by a great many visitors.

MR. ARNOLD-FORSTER:—The resolution is that you accord a hearty vote of thanks to Sir John Lubbock for the part he has taken in these proceedings. Sir John Lubbock has not only been present at this meeting, but he spent an hour before this meeting began in going carefully through the exhibits. I ask you to give him a hearty vote of thanks.

The resolution was carried unanimously and with acclamation.

SIR JOHN LUBBOCK:—Mr. Arnold-Forster, Ladies and Gentlemen,—I am sure you will all agree with me that although Sir Lyon Playfair did not know he was going to speak, he has given us a most interesting address, and one for which we are very grateful to him. He alluded to the very interesting statement which has recently appeared with reference to the chimpanzees using fire. But I think he need not be alarmed that his definition will be undermined in that respect. Emin Pasha is a good naturalist. He has been in communication with naturalists both here and in Germany, and if he had really made such a very remarkable observation as that, I think we should have had it from him direct, and not second-hand. I cannot help thinking that the statement must have originated in a mistake, and I hope Sir Lyon Playfair will not too hastily abandon the definition which he had arrived at. I am very much obliged to you indeed for the kind manner in which you have received me. This is not the first occasion I have had the honour of addressing you from this platform. It is always a very great pleasure to come to a hive of industry of this kind, where work is to be seen in its highest aspects. I will not detain you any longer. No doubt you are all anxious to examine the very interesting Exhibition, and I conclude, therefore, by again thanking you for your very kind reception of me, and by formally declaring the Exhibition now open.

The proceedings connected with the opening ceremony were then brought to a close, and Sir John Lubbock, followed by a party of visitors, went through the various departments of the Exhibition.

SHOP:

A CORNER FOR THOSE WHO WANT TO TALK IT.

*** *In consequence of the great pressure upon the "Shop" columns of* WORK, *contributors are requested to be brief and concise in all future questions and replies.*

In answering any of the "Questions submitted to Correspondents," or in referring to anything that has appeared in "Shop," writers are requested to refer to the number and page of number of WORK *in which the subject under consideration appeared, and to give the heading of the paragraph to which reference is made, and the initials and place of residence, or the nom-de-plume, of the writer by whom the question has been asked or to whom a reply has been already given. Answers cannot be given to questions which do not bear on subjects that fairly come within the scope of the Magazine.*

I.—LETTERS FROM CORRESPONDENTS.

Hand Saws.—A. R. (*Scorrier*) writes to AMATEUR and others:—"In reference to hand saws (see page 701, Vol. II.) the sketches are reduced, consequently a greater number of teeth are given to the inch. The number of points should be four to the inch in the rip-saw, and from five to six in the cross-cut saw for general work."

Formulæ.—A. R. (*Scorrier*) writes, in sequence to BRASS (see page 699, Vol. II.):—"I hope I have given no offence in writing as I did in reference to formulas in No. 89, page 599. The reason I made such remarks is—more than once really good workmen, who may not be, like myself, too well up in arithmetic, have said to me, 'I don't understand so and so;' and more than one has said the same in reference to your reply on 'Speeds of Pulleys.' I thought, therefore, if I could make the thing more clear and simple, I was only giving a helping hand to those who needed it. I agree with you that we don't all read WORK through the same pair of eyes; if so, there would have been no need for me to write as I did."

II.—QUESTIONS ANSWERED BY EDITOR AND STAFF.

The "Ariston" Organette.—C. J. G. C. (*Brighton*).—The "Ariston" Organette has a scale of 2 octaves—we believe from C to C, but C. J. G. C. can easily ascertain this by purchasing a pitch-pipe or tuning-fork, giving the C or A, and then testing it. The paper tunes are punched by a machine, and must be made with great accuracy to get the right duration for crotchets, quavers, and for rests, etc.; also for the different time marks, so that our correspondent, even if a skilled musician, could hardly succeed in making them by hand. In any case it would be far cheaper to buy them, as they can be obtained for about fifteenpence each.—G.

Brass Instrument Bruises.—METAL WORKER.—Musical instrument makers employ various methods for removing the bruises in brass instruments, according to the position of the bruise. In some cases, in order to avoid taking the instrument to pieces, the top of a piece of stout brass wire is soldered to the indented spot, and the bruise is then *pulled* up. This is, however, only practicable in the case of slight dents. Where the damage is too serious for this treatment, and is in the smaller tubings or too far round the *main bow* to be accessible from the bell, the instrument must be taken to pieces at the joints, and even then special tooling is required to fit the bend. By means of a series of steel balls of graduated sizes, which are screwed on to the point of a curved steel-tapered arm, the bruises from tubes of various calibres can be removed. The arm is fixed in a vice, and a ball screwed on the top to fit the diameter of the tube which it is desired to level. This is then thrust over the arm, and the bruise pressed up from the inside on the steel ball. We should, however, recommend our correspondent not to attempt the repairing of brass wind instruments, unless he has had some practical experience, as it is easy to ruin the musical quality by altering the proportions of the smaller tubes. If he will attempt it, let him try his 'prentice hand upon some old worn-out instrument, or he may purchase his experience dearly.—G.

Old Violin.—T. L. (*No Address*).—Get the surface quite even with fine sandpaper, and cover with a spirit varnish strongly coloured with dragon's blood or sandal wood. Should these be redder than you fancy, add a little saffron; this will modify the tint, and make it slightly "orange." A varnish composed of four parts of seed lac to one part of benzoin, dissolved in methylated spirit, will answer your purpose very well. Colour the spirit, and filter before adding the gum.—B.

Dissolving Varnish.—MANCHESTER.—Dragon's blood is soluble in spirit, turpentine, and some kinds of oil. If you get it in the powder form or pulverise it yourself, you will probably have no difficulty with it, but the idea of anyone living in a city like Manchester wishing to prepare his own varnish is rather peculiar. Varnish making is not a kind of manufacturing that can be practised on a small scale by amateurs with much success.—D. D.

Recipes for Polishing, Paste for Cleaning Brass Plates, and Solid Ink for Stencils.—N. W. (*Leicester*).—(1) Soft soap, 2 oz.; rotten-stone, 4 oz. (2) Rotten-stone in paste, with sweet oil. (3) Rotten-stone, 4 oz.; oxalic acid (in fine powder), 1 oz.; sweet oil, 1½ oz.; and turpentine, sufficient to make a paste. The above are used to clean brass-work, when neither varnished nor lacquered. The first and last are best applied with a little water; the second with a little turpentine or sweet oil. Marking or "Packer's" ink is the "bottoms" or settlings of the ink manufacturers. It is chiefly used in a solid state by packers for marking bales, boxes, etc.—N. M.

Polish.—H. W. (*Tottenham*).—Pine does not look well when finished with wax polish, which, by the way, is not generally adopted for any kind of bedroom furniture, though, beyond custom, there seems no good reason why it should not be. If, as you suggest, you want to make a really good bedroom suite, why not use mahogany, ash, or American walnut? Any of these will be much handsomer than pine, and, as you are no doubt aware, the extra cost will not be great if you go to work in the proper way for getting the stuff. Yes, wax-polishing has been very fully treated in WORK in the current volume. As all the back numbers are in print, you would find it a great help in your hobby to get them.—D. D.

Cutting Machine.—J. H. (*Harpurhey*).—The price of a machine would be about £100; you could not make it for that sum, and, apart from the cost, the undertaking would be too much for you.—G. C.

Folding Screen.—F. C. (*Swanley Junction*).—I should advise you to use wood ¾ in. or ⅞ in. thick for a screen of the height you mention. I am unable to tell you how to construct a screen to fold both ways, and yet show no crevice between each frame. There have been a few notes in WORK already dealing with screens; perhaps they will assist you. Gold, silver, and coloured paper is obtainable at or through any fancy stationer's.—J. S.

Lathe Making, etc.—J. H. F. (*Nottingham*).—You should advertise your address and cheap prices in the "Sale and Exchange" column of WORK.

Plumbing Book.—W. R. (*Kerry*).—The address of Messrs. Houlston and Sons, who sell the "Plumber and Painter and Glazier One Shilling Hand-Book," is Paternoster Row, London, E.C.

Diamonds for Boring and Cutting Rock.—J. S. (*Aberdeen*).—As there are two or three ways of using diamonds for drilling, and as tools are wanted in each case, I will give you two addresses. The first is J. E. Slyper, 40 and 41, Kirby Street, Hatton Garden, London, E.C. Here you will be able to obtain a quotation for any description of diamond that you may send particulars of, not forgetting to mention the quantity required. If the black variety from Brazil (carbonate) is required, the cost will be rather heavy to bear. Any tools that you may wish for can be supplied by Messrs. Cotton and Johnson, 14, Gerrard Street, London, W. This firm also keeps in stock diamond already powdered, and they will be perhaps the better of the two to send to if small quantities only are required. The first mentioned firm are diamond cutters, and I do not think would care to be bothered for very small quantities, but you might write to them and see.—H. S. G.

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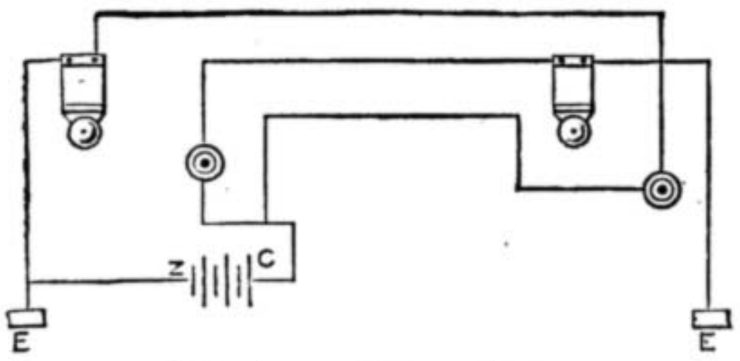
Telephone.—A. W. (*Wakefield*).—Your letter speaks of former favours and expresses very kindly your thanks. I do not remember having given you any assistance on this point before. But, all the same, you are perfectly welcome to whatever assistance I can give you now or at any future occasion. I cannot make much of your letter, and I am sorry to say that I can make less of your sketch. I gather this much: you have a pair of telephones complete with bells, batteries, etc.; one of these is fixed in your bedroom, and the other in your workshop at a distance of 150 yards. These, according to your letter, have been supplied by a respectable firm of electrical engineers and answer your purpose admirably. I presume they have been fitted by the parties who supplied them. Is this right? If so, leave them as they were and do not attempt to make any addition to the connections, for you may be setting up currents which



Telephone Connections.

will run contrary to first directions, and thus interfere with their proper working. Besides these, you have two bells, two pushes, and one battery. One bell is also fixed in your bedroom beside the telephone, and the other at another part of your works 200 yards distant. This is right, I think. You have thus two complete electrical circuits running in contrary directions. Well, just allow them to be completely separate from each other. Take away all the connections from the telephone circuit which were not originally there, and make a new arrangement for your two separate bells. I do not wonder at you not being able to ring the distant bell when you pressed the push A in your sketch, neither would you yourself if you just looked at it closely. Your line runs direct from push A to push B; now, as there is a break in every push (you surely do not want pushes to alter their conditions to suit your requirements), it would be necessary for the current to jump from one spring of the push to the other before it could get to the bell; but even should such a thing happen, it would not reach the bell, for you have the carbon of the distant battery connected to push B, so that the current coming from that battery would meet that coming along the line, and in that case something is bound to happen, although the consequences would not be quite so disastrous as when two locomotive engines going at express speed meet on the one line. You want me now to tell you how to connect up your bells and use up the materials which you have. You have two bells, two pushes, and one battery. These can be easily connected together in different methods, but I think the one shown before will suit you best, being the most simple. Be careful in joining your wires to follow the sketch, and in making joints in your wire, scrape away carefully the covering, and while soldering, use resin as a flux; and when the joint is made, cover up with gutta-percha tissue. Being a plumber, you will be able to make a good joint. To ring your bells properly, you will require not less than three No. 2 Leclanché cells, and all your wires must be insulated.—W. D.

Impressions.—H. M. (*Leeds*).—I am sorry that I am unable to describe a method for taking out an impression from the leather cover of your book. It is one of the impossibilities one meets with now and again. All that you can do is to cut the piece out, and insert another piece to fit exactly. You might insert a different coloured piece with effect. But this will have to be done judiciously in your case, as I see that the book under discussion is a Bible.—G. C.

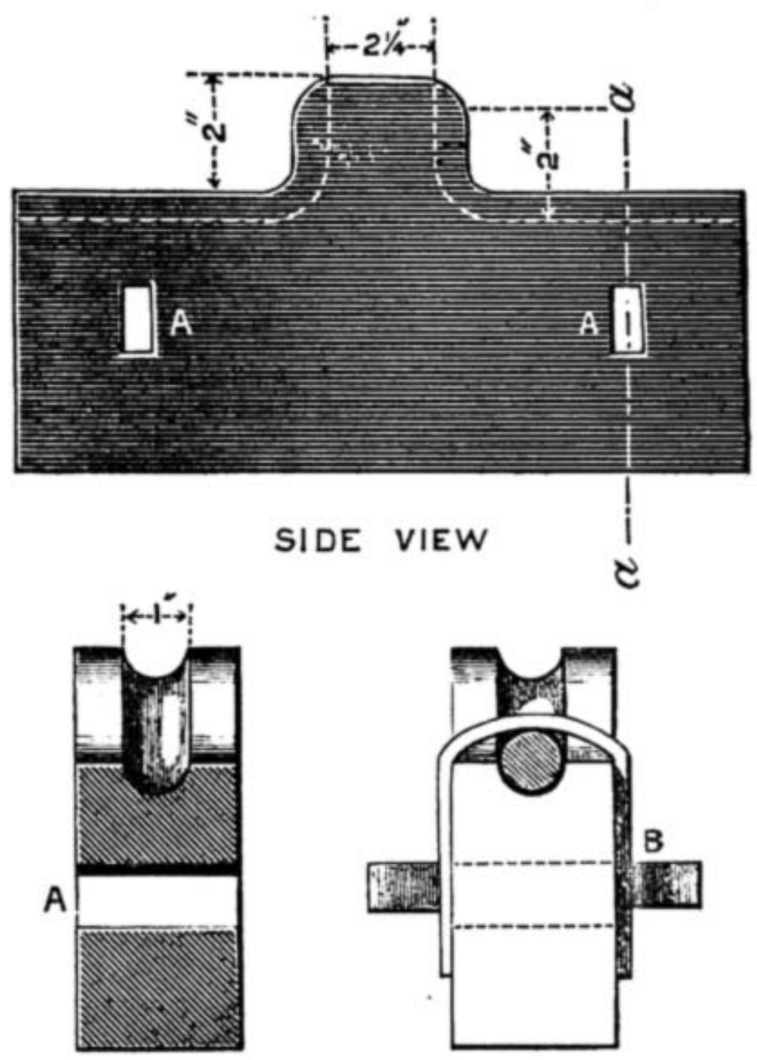
Parchment Diaphragm.—F. W. B. (*Golcar*).—These diaphragms are all more or less subject to atmospheric changes, and it is difficult to remedy them. I think you should get a pair of new ones, and try gold-beater's skin, or even bladder skin, for them; and be sure when putting them in that they are well stretched and clamped closely. It is usual to have a metal ring round the edge, to ensure the clamping being perfect.—W. D.

Die Stamping.—C. L. (*Hulme*).—I cannot treat this subject fully in "Shop." Colour stamping is done with one die and with several dies, according to the style. The samples sent are very nice, and can only be done by experts. The large sample is done with three dies, I think: the one fitting over the other. The small sample is done with one die. The gold is put on with the ordinary varnish used for colour stamping. After it has become dry it is stamped again to burnish it.—G. C.

Book Boards.—H. N. (*Broadmoor*).—I understand that you have an idea of making moulded boards for scrap albums, these boards to be a certain size. Now, if you know anything about reliefs, scraps, or pictures of any kind, you must know that the sizes of these are very varied; it is rarely possible to get two the same size. Looking at it from this point, I do not see what would be the use of a portion of the page being sunk: there would be no end of waste space in fitting the reliefs in the pages. When making scrap albums, we make the back thicker than the rest of the book, so that when it is filled it will lie nice and flat. Your idea *might* do for photographs. I do not say that it will, seeing that the sizes of the cards are well known, and but few of them. You say that you are desirous of eliciting the approval of manufacturers. Why not submit your idea to a paper-maker, or get the advice of a patent agent? Pulp boards could be blocked in a much simpler method than the one you propose; and they are so done. But I do not think they are used for scrap albums in the way you have laid out, as they would not do at all.—G. C.

Error in Telephone.—W. R. (*Glasgow*).—You are quite right in regard to the above. I did not observe it until I read your note. It should have been printed as you have it—that is, with the hook pivoted at the end of the line wire, and free to move between the two connections of the receiver and bell-push. However, as these connections are given plainly, it really does not matter, for in actual practice anyone setting out a switch-board would be able to make the connections all right from the sketch.—W. D.

Cress.—J. F. (*Bogay*).—You want a block like that shown in the figure. It is of cast iron, made from a pattern cut to precisely the same outlines, and the cottar-way holes A, A, are cored out by means of pocket prints. The crank is turned round, and hammered into the semi-circular recess, whose



Cress Block and Parts.

dimensions you will see correspond with the sizes given in your sketch, and its ends are clamped down with straps and cottars shown at B. The outside dimensions of the block are of no importance, so long as you have it strong enough to stand the shocks of hammering.—J.

Bookbinding.—H. B. (*Jarrow-on-Tyne*).—At both the beginning and ending of your letter you express the hope that I will not take offence at anything you have written. I am exceedingly anxious that your mind should be set at ease on this point. Hence my reason for giving it precedence. Let me then assure you that your letter, instead of giving me offence, was the cause of much amusement to me. I was so delighted with it that I have read and re-read it again and again; and just by the way, allow me to give you a wrinkle in letter-writing. Throw out that lovely violet shade of ink, and use common black. I know that the black is very common and much cheaper than the other, but then, in this case the common is the best, inasmuch as the violet is trying to the eyes. Now as to the contents of your letter. You want me in the course of my "articals" on bookbinding to write as a working-man to working-men. I have always striven to do so; in fact, I could not do otherwise, for I am a working-man. As to the illustration which you give, taken from my reply to P. B. on page 44, allow me to explain to you a little matter which you seem not to be aware of: it is simply that WORK is not an amateur magazine entirely. We have, therefore, to write to practical workmen; and as the querist referred to asked for the prices of the articles specified, I gave him the best answer I could, as I would to you if you asked me to suggest a makeshift for a certain thing. Supposing you had asked me for the price of a "glue-pot"; it would have been ungentlemanly to have given you the price of a marmalade jar. I think it is not necessary to say anything further. I suppose the Editor will deal himself with the other part of your letter. If you have a dictionary, you might look up the meaning of the word "artical."—G. C.

Telephone Connections.—J. H. (*Mullingar*).—I cannot make out from your letter or diagrams what is wrong with your telephones. The fault may be in the receiver or transmitter. Faults may occur in any part of the circuit, and sometimes, although they may be very small, are a source of much trouble. If you can manage it, test your line in the first place, and if you find no fault in it, look to your instruments, testing each one separately, and thus you may be able to get at the fault and the means of remedying it. At any rate, I cannot help you unless you try and make your case a little plainer.—W. D.

"Holdfast" Egg-Cup.—NEMO (*Manchester*) has unfortunately lost a hand—a misfortune the more to be deplored, as from his letter and what he tells of his work, it is evident that he would have kept two hands busy to good purpose. He asks for some plan on which he might make a cup which would hold his egg still whilst he eats it. Might not he make a simple and cleanly contrivance on the principle of the crayon-holder, as in the annexed sketch? The egg would be held firmly by a ring made to slide up the stem. The foot he would make steady by casting it in some heavy metal. The bottom ends of the clips he would insert in his mould before casting it; and if he could not make or get them made readily, the middle parts of two metal spoons would serve. He might, of course, steady his egg by an elastic ring inside a heavy cup, but this would be less cleanly. Or he might turn a wooden cup, load the foot with lead, saw a slice out of the centre, and draw the two parts together when his egg was in, either with a ring as above, or with a screw below the cup. These are given as alternative suggestions. As regards naming his coins, he will find Colonel Thorburn's "Guide to the Coins of Great Britain and Ireland" (Upcott Gill, Strand, W.C., 6s. 6d.) a most useful handbook in small space, and more especially so as it gives some idea of values.—M. M.

"Holdfast" Egg-Cup.

Piano Reeds.—W. H. C. (*No Address*).—If you intend to make a round fall to your piano, you must make your cheeks 2 in. wider, for this reason: that you fit your round fall in between the cheeks, and make a mark round the top side of the fall on the inside of the cheeks, then you cut round carefully with a bow-saw. The piece of wood you cut off is used for a caul to press the reeds round the cheeks. Proceed in the following manner:—Get your reeds out $\frac{1}{16}$ in. wider than your cheeks: as they shrink a little, work the reed with your plane to the pattern you require, and leave the outside edges square, as you can work these after they are on. You will need to steam them for this purpose. Make a narrow box the length of the reeds, fill one end with a piece of wood, and bore a hole in the centre large enough for the spout of your kettle to enter; this is placed on the fire with water in, the reeds are placed in the box, and a piece of sacking is stuffed in the end to keep the steam in; let them remain steaming until you find they will bend. Now, before you glue the edge of your cheek, use a rasp or coarse file on it, and take all the lumps off and size with thin glue. Of course, you will need pressure, large handscrews or cramps being used. When glued down, leave all night to dry, then clean up with glass-paper.—T. E.

Cramp and Block.—D. M. G. (*Old Cathcart*).—The combined cramp and block on page 3, Vol. II., for both cutting and fixing mitres of picture-frames is ingenious and good, but personally I should prefer separate appliances for the two purposes. D. M. G. ought to procure all the back numbers of WORK, in which he will find several excellent mitre cramps and blocks illustrated. He should also watch the "Shop" columns, for there are now in print several answers that would go far to answer his question.—B. A. B.

Imitation Ivory.—C. W. (*Kensington*).—Xylonite, which seems to be the best imitation ivory, can be procured in thicknesses varying from $\frac{1}{100}$ of an inch to 1 in. in thickness. It works very smoothly and kindly with wood-carving tools, and it is also adapted for modelling by means of heat and pressure: in fact, very many of the Xylonite Company's productions—their salad-servers, for example—are made that way; for that purpose properly made and finished dies are, of course, necessary. This same material is used for fretwork too. The Xylonite ivory is kept in four qualities: "grained ivory;" then two kinds of ungrained, called "ivory white," one quality being much darker than the other; the fourth is called "snow-white." Besides the imitation ivory, many other colours are kept, some of which are excellent imitations of coral, tortoiseshell, and lapis. The address is the British Xylonite Company, Limited, 3, Fore Street Avenue, E.C. Will you please clearly define the thickness, size, and quality, that you require, when you write for prices?—H. S. G.

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III.—QUESTIONS SUBMITTED TO CORRESPONDENTS.

Electric Light.—J. S. H. (*Dublin*) wants to know how to construct a small electric light to burn for five or ten minutes at a time by making contact with an ordinary bell-push or otherwise. Can any reader give the desired instructions in "Shop?"

Wood-Slicing Machine.—W. H. (*Belfast*) writes:—"Will any reader inform me where I can procure a machine that will slice wood as thin and clean as the wood used for bandbox making? I want a machine that will slice blocks of wood about 12 in. by 7 in."

Hardened Putty.—J. G. (*Hull*) asks for "The best way to prevent putty from getting hard."

Pig-Scalding Tub.—J. G. (*Hull*) writes:—"I should be glad to know the best method of making a pig-scalding tub about 6 or 7 ft. long, also size of wood required, and all other particulars. A sketch would be very acceptable."

Packing-Cases.—W. G. (*London, N.*) writes:—"Will anyone tell me a more simple way of fitting up packing-cases than that given on p. 293, Vol. II.?"

Sand-Blast.—MIEUX QUE ÇA writes:—"Will anyone impart a word or two of practical information on the construction of the sand-blast?"

Draught-Board.—J. W. M. (*Driffield*) writes:—"Can any reader oblige me by letting me know the cleanest, best, and quickest mode of making a draught-board on plate-glass, size 15 in. by 15 in. square; and the best colours for the squares? Board to be 12 in. square inside, with 1½ in. border round to make 15 in. I should like to know the cost of it as near as possible. The board to be put in about a 2 in. moulding-frame either plain or gold, with back complete, or to have it to fix on four legs like a table, but to be loose when not playing."

A Cold Room.—SESTO writes:—"There are several methods of operating a 'cold room' whereby perishable articles can be well preserved during hot weather, and that for months at a stretch. I shall be glad to know who are the makers of the best apparatus, and, perhaps, how it operates. I may state that it is to be capable of keeping the temperature, if necessary, considerably below the freezing point."

Hand-Power Circular Saw Bench.—S. P. (*Penarth*) writes:—"I wish to ask assistance in the construction of a hand-power circular saw bench which I am wishful to make, one that will require the least manual labour to drive it. I should require it to cut stuff up to 5 in. thick. Being a joiner by trade, I would make wooden standards and framing (if advisable), also the best and cheapest firms to get the required wheels, plumber blocks, etc., with probable cost (complete). Any suggestions or sketches will be esteemed a favour."

Castings.—J. D. (*Glasgow*) writes:—"Will anyone tell me where I can get a set of castings for 2¼ in. or 3 in. lathe back-geared in Glasgow; also the price?"

Schooner Rigging.—T. C. (*Manchester*) writes:—"I have a 'Model Schooner Yacht,' 4 ft. long by 8 in. broad, and do not understand how to full rig it. Would any reader kindly inform me?"

IV.—QUESTIONS ANSWERED BY CORRESPONDENTS.

Frosting Glass (Windows).—H. B. (*Brighton*) writes, in reply to BETA (see page 734, Vol. II.):—"Thoroughly clean the glass inside and give one coat of the following: With a soft brush, leaving a nice smooth finish, make a clear solution of gum-arabic, then prepare a very strong solution of Epsom salts in hot water, and apply to the glass while warm as directed above, where it will crystallise and form a very pretty pattern, and is very durable. Another, but very common and somewhat unsightly, method is to dab the glass all over with a piece of soft glazier's putty and allow the marks left to dry; this sets very hard and is durable, but the former plan is by far the best and easiest, costing only about threepence for what is really a pretty decoration."

Setting a Razor.—J. H. (*Leicester*) writes, in reply to J. C. (see page 554, Vol. II.), who asks for the best way of setting a razor;—"I do not know if my way is the best, but I can always depend on getting a good edge on my razors. First of all, get a razor, then a good stone (I believe there have been directions in this paper for choosing a good stone), moisten the stone with a few drops of sweet oil, and place it on a firm bench or table, then take hold of the blade firmly. To avoid cutting your fingers, lightly rest the fingers of the left hand on the blade, while the right holds the haft; lay the blade flat on the stone, the side of the blade resting on the stone with the edge just touching it, the edge of the blade being from you. Then, while applying some pressure, work the blade along the stone in a straight line from you, and draw it back without pressure (Fig. 1). After a few passes, turn the blade and reverse the action. Draw it to you with pressure and push it back without (Fig. 2). Never make the back of the blade go first, or you will produce a thin useless edge which will double up. If you have two stones, all the better: one rough to grind on, and the other smooth to put a smooth edge on the blade. Take care to move the blade backwards and forwards in a straight line, not in a circular motion (Figs. 3 and 4), and keep the blade always at the same angle, or you will cross the line of friction and fail to produce a good edge. The effect of the crossing of the lines of friction is seen in Fig. 6 considerably magnified; if properly set, it will be as seen in Fig. 5. Be very careful to keep trying the blade after every few passes, and apply very slight pressure, or you will rub the edge off as fast as you put it on; when properly set, you will be able to cut a hair through when held in the fingers, or a piece of tissue paper with a clean cut: if it drags and tears the paper, you have not got a good edge; you have either crossed the lines of friction, not set it enough, or have applied too much pressure and turned the edge: to remedy the first and last of

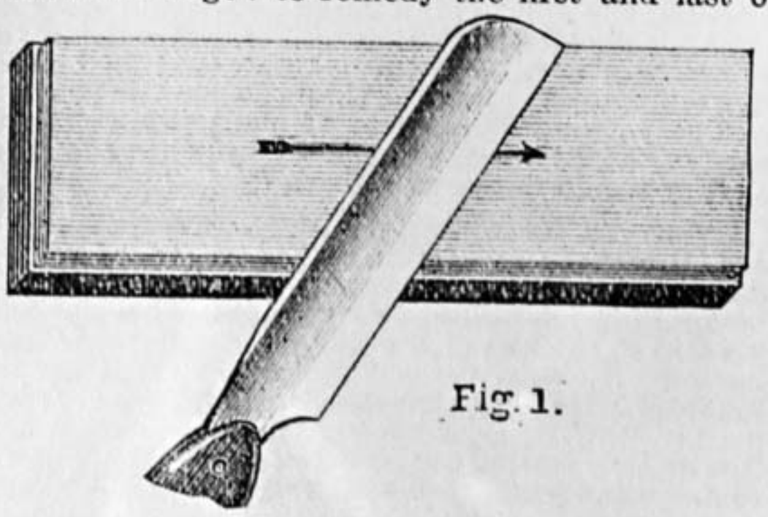

Fig. 1.

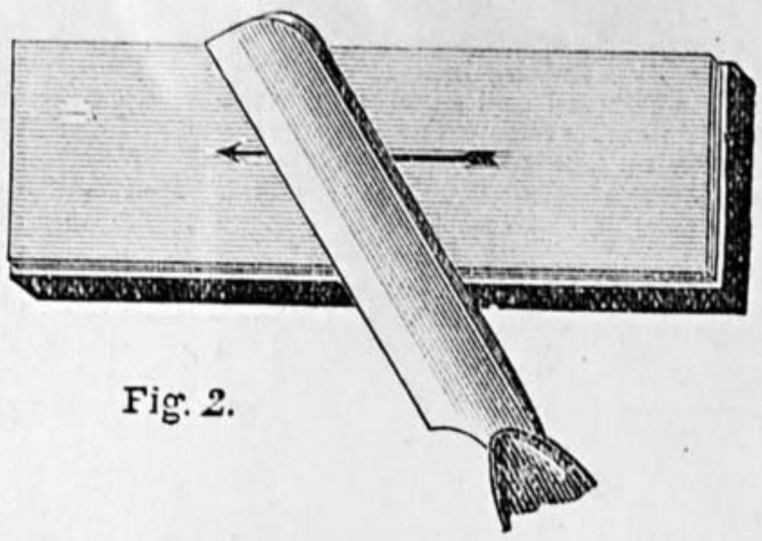

Fig. 2.

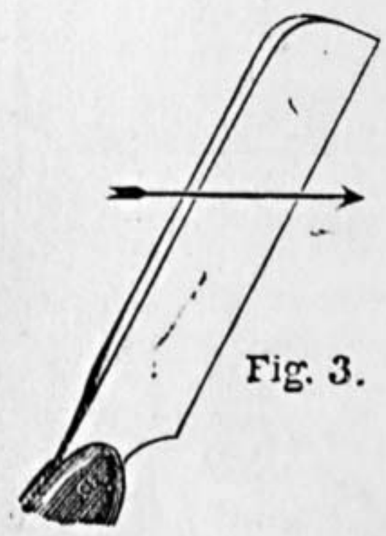

Fig. 3.

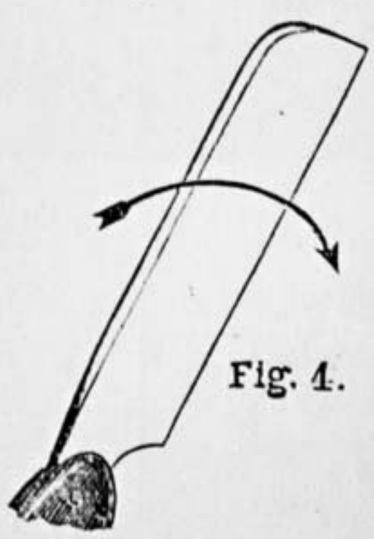

Fig. 4.

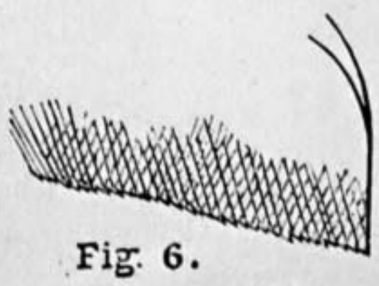

Fig. 6.

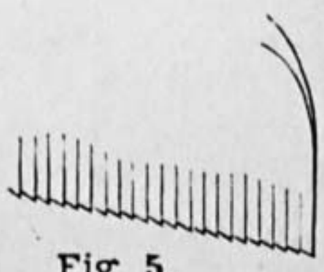

Fig. 5.

Setting a Razor.

these three, you must take off this edge and commence again. But we have not yet got through the wood; many who can set a razor cannot strop it. Get a good strop, a piece of buff (soldier's belt preferred), and if you have a heavy hand, try to strop the back of the razor; this will help you to strop it without turning the edge; be very careful to apply very slight pressure, and turn the razor on the strop with the edge upwards; never allow the edge to turn downward on the strop. If J. C. follows these directions, I have little doubt that he will find no difficulty in setting his razors."

V.—BRIEF ACKNOWLEDGMENTS.

Questions have been received from the following correspondents, and answers only await space in SHOP, upon which there is great pressure:—F. J. S. (*Deptford, E.*); AMATEUR; C. F. W. N. (*Forest Gate*); W. R. (*Manchester*); J. G. (*Glasgow*); O. C. (*Derby*); W. E. H. (*Hebburn-on-Tyne*); E. D. (*London, S.E.*); L. F. (*Plymouth*); P. J. R. B. (*Manchester*); S. S.; A NEW READER; J. M. (*Newport*); J. C. (*Belfast*); BEACON; J. J. (*Leeds*); W. J. F. (*Cork*); A. R. (*Scorrier*); B. T. W. (*Leeds*); J. S. (*London, N.*); STEAM ENGINE; W. P. (*Withington*); MATHEMATICS; E. R. N. (*Forest Gate*); H. J. S. (*Homerton, E.*); G. W. (*Barnsbury, N.*); A. G. (*Cardiff*); J. Y. C. (*Croydon*); J. O. (*Chatham*); J. M. (*Parkstone*); J. J. D. (*Dowlais*); BRITANNIA CO. (*Colchester*); H. T. G.; G. S. W. (*Walford Heath*); TOMMY JEE; H. B. (*Haydon Bridge*); J. T. (*Huddersfield*); T. W.; A. H. (*Maidstone*); J. M. (*Halifax*); C. M. C. (*Forest Gate*); C. A. (*Rawtenstall*); G. S. (*Lowton, N.*); A. B.; J. W. (*Birkenhead*); IMPROVER; D. M. S. (*Glasgow*); C. F. N. (*Cheltenham*); R. M. (*Liverpool*); H. B. (*Brighton*); B. A. (*West Kensington*); E. H. H. (*Chatham*); J. L. (*Airdrie*); CONSTANT READER; R. W. W. (*South Shields*); J. E. (*Chatham*); T. W. (*Bradford*); W. H. T. (*London, S.W.*); G. V. (*Esclairmonde*); J. T. (*Leeds*); H. A.; W. A. H. (*London, S.E.*); BLOWPIPE; CAMERA; CYPRINE NORWICH; W. J. S. (*Glasgow*); W. O. J.; TREACLE PUSHER; S. W. (*Kidderminster*); OBLONG; DEAN FOREST; T. E. B. (*Farrington*); O. B. R. (*New York, U.S.A.*); OGRAPH; AMATEUR; W. S. (*Highbury*); BRASS; D. W. (*Liverpool*); BANNERMAN; R. G.; NORTHERNER; S. S. (*Salford*); S. S. G. (*Walworth*); F. J. D. (*York*); COMME IL FAUT; A. S. D. (*London, S.E.*); J. B. (*Southwark*); J. S. (*Amsterdam*); W. E. D. (*King's Lynn*); RULER; S. A. L. (*Walsall*); J. E. (*Skipton*); LAUNDRY; J. M. B. (*Dumfries*); G. C. (*Huddersfield*); EXILE; J. T. (*Manchester*); J. D. (*Glasgow*); DESPAIR; R. T. (*Paisley*); W. J. J. (*Sunderland*); W. T. (*Lymington*); A. P. G. (*London, W.*); E. T. (*Blackburn*).

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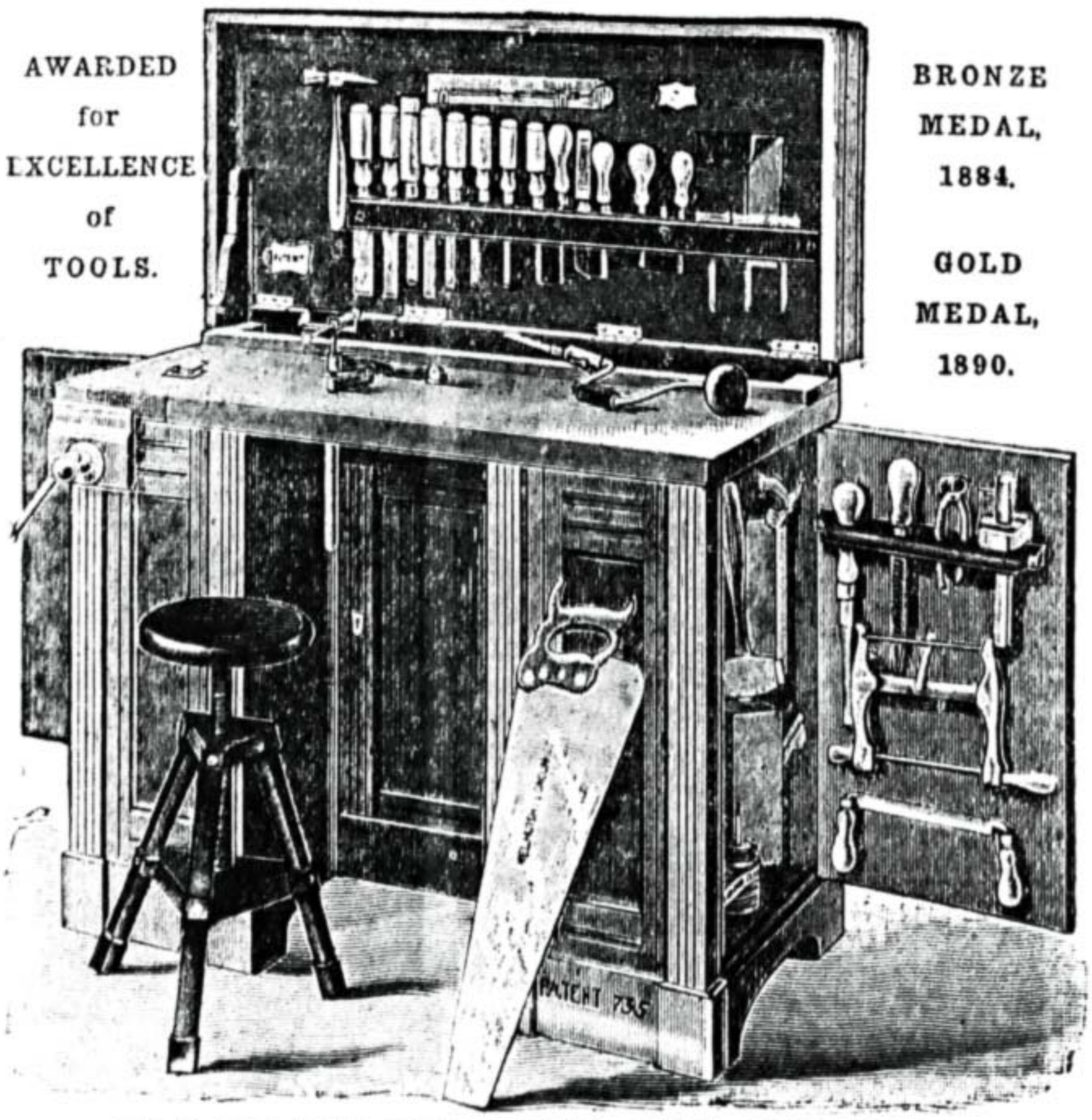

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